

# The Canadian Medical Association Journal



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# The Canadian Medical Association Journal

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## PHYSIOLOGY OF THE INTRACRANIAL CIRCULATION

BY J. J. R. MACLEOD, M.D.

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CONSIDERED from a physical standpoint the circulation through the brain has been recognized for long to be unique in comparison with that of any other organ or tissue in the body with the exception of the bone marrow. Encased in the rigid cranium, the volume of the brain cannot, like that of other vascular areas, expand and contract in proportion to changes in the blood supply; neither can the calibre of its blood vessels become altered, unless some special mechanism magenist whereby a part of the cranial contents are quickly expelled from and aspirated into the rigid case. In a general way, the physical conditions of the intracranial circulation are similar to those existing in a flask full of water and having a thin-walled rubber tube suspended in the water with its free ends connected with glass tubes passing through the stopper of the flask. If fluid be made to circulate through the tubing, no change in the calibre can be produced by altering the pressure of inflow; but the rate of discharge from the other end of the tube will be proportionate to the pressure. Although the tubing itself is readily distensible and elastic, these properties are entirely annulled by the incompressible fluid in which the tube is suspended.

If any expansion or contraction of the tubing as a whole is to occur, provision must be made for changes in the volume of fluid in the flask by inserting in the stopper a third tube connected with

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Being part of a symposium given at the Medical Week at Hamilton, May 31st, 1918.

an overflow flask, and in applying this second model to represent the circulatory conditions as they exist in the brain, the question arises as to whether the cerebro-spinal fluid which lies in the large subarachnoid spaces at the base of the brain and in the ventricles, by communicating through the foramen of Magendie with the spaces surrounding the spinal cord, may not be capable of functioning as the overflow fluid. This is at least conceivable, especially when one bears in mind that some outflow is also possible along the sheaths of certain of the cranial nerves. Recent investigation has, however, clearly demonstrated that under normal conditions the amount of cerebro-spinal fluid is too limited to make it of any significance in this connection.

Although it is therefore improbable that the vessels as a whole could expand or contract, it is still possible that some provision might exist by which extra room could be made to allow of *localized* dilatation of certain parts of the vessels. The veins, for example, might contract in proportion as the arteries dilated and the possibility becomes all the more likely when we consider that because of the great capacity of the cerebral veins, their lumina might be considerably constricted without any serious obstruction being offered to the blood-flow through them. Such a reciprocal dilatation and constriction of the proximal and distal halves of a thin-walled rubber tube suspended in water in a closed flask can be demonstrated provided some resistance be inserted between the two halves. This resistance would be represented in the intracranial vessels by the capillary area. It is impossible to say to what extent this reciprocal mechanism between arteries and veins may prevail, but in any case it cannot well extend beyond the cerebral veins to the sinuses, since these are partly embedded in the cranium itself and are protected by relatively thick membranes on their free sides. The mechanism may be employed for permitting the arteries of a local area to expand, but it cannot obtain over any large area, since otherwise the total outflow of blood from the sinuses through the jugular foramen would be curtailed, which we know to be contrary to what actually occurs when the arterial pressure is raised, and which moreover would be highly detrimental, since it would cause self-strangulation of the intracranial blood-flow.

These physical considerations lead us to expect that there cannot be any dilatation or constriction in the intracranial vessels which is comparable with that which occurs in other vascular areas, although it may take place to a degree which is limited by the extent to which the cerebral veins can be passively contracted or

expanded without curtailment of the blood flow. Acting to this extent, the dilatation produced in the arteries by each cardiac systole accounts for the rise in pressure which occurs simultaneously in the venous sinuses (as measured in the torcular Herophili), but it is unlikely that the amount of blood supplying the brain will be determined by local dilatation or constriction of the blood vessels, as is the case, for example, in a gland or muscle. Of this we are certain, that the total volume of blood within the brain case at any given moment can undergo no considerable change. Provision for more or less blood must therefore be afforded by changes in the velocity of flow.

We must now proceed to test these hypotheses by physiological experiment, for, if they are found to apply to the intracranial circulation, the conclusion becomes inevitable that changes in the total blood supply to the most important organ in the body are dependent not on any local adjusting mechanism in that organ itself, but upon conditions prevailing in other parts of the body, with the possibility that a local vasodilatation may be made possible by a secondary compression of neighbouring venules, or perhaps even by an active constriction of the arterioles of neighbouring inactive centres.

The questions of greatest practical importance are, therefore, as follows: (1) What determines the intracranial pressure, and how does this vary during each heart beat? (2) If there can be no change in the actual volume of blood in the vessels as a whole, what provision is made to provide changes in blood supply with varying degrees of activity of the brain, and how are these changes brought about? (3) Is it possible without change in the total volume of blood in the brain for certain vascular areas to expand at the expense of others that correspondingly constrict?

*The pulsations of the brain and the cause of intracranial pressure.* Examination either of the fontanelles in an infant or of the surface of the brain exposed by trephining shows distinct pulsations, but this does not prove that similar pulsations occur in the intact brain case, for the absence of a part of the cranial wall might be responsible for the pulsation. The presence or absence of pulsation must be sought for in the still rigid brain case. This has been done by closing a trephine hole by a glass window through which the cranial contents can be seen when strong illumination is used: pulsations of the vessels are clearly visible. To determine the exact relationships of the pulsations, the trephine hole is connected with a delicate recording tambour by screwing into it a brass tube closed at

its inner end by a thin rubber membrane. It has been found that the arteries expand somewhat with each cardiac systole, and that there are further expansions with each expiration, but not with inspiration, as is the case in other vascular areas. The room for the cardiac expansions is no doubt provided mainly by compression of the cerebral veins, thus causing the blood within them to exhibit corresponding waves of pressure. The room for the expiatory expansion is possibly provided in part at least by movement of cerebro-spinal fluid into the spinal canal. The reason why expiration and not inspiration causes the increase in volume is that there are no efficient valves between the right side of the heart and the cerebral veins. This allows the expiratory rise in venous pressure which is well known to occur in the former to be directly transmitted to the brain.

This brings us to the second part of our first question: What determines the intracranial pressure? To answer it we must know something of the method by which the pressure is measured. This has been most successfully done by Leonard Hill, who devised an instrument called the cerebral pressure gauge, consisting of a brass tube closed at one end by rubber membrane and screwed into a trephine hole. The outer end of the tube is joined to a narrow glass tube connected with a pressure bottle. The whole system is filled with fluid except for a minute bubble of air in the narrow glass tube. Any changes in pressure in the brain cause corresponding movements of the bubble, and the magnitude of the change is measured by readjusting the pressure bottle so as to bring the bubble back to its original level. It has been found that the pressure may vary from zero to 50 mm. Hg. (as in strychnine convulsions), and that these variations depend entirely on circulatory conditions, there being no compensatory mechanism by which the pressure is kept constant. The brain continues to functionate in normal fashion independently of pressure. The average pressure under physiological conditions is 100-130 mm.  $H_2O$ .

*The intracranial pressure varies directly with the venous pressure within the skull, and only passively follows changes in the pressures in the arteries and veins of the systemic circulation.* This implies that the efficiency of the cerebral circulation will be dependent very largely upon alterations in the capacity of the splanchnic area, the greatest reservoir of blood in the body. By actual measurement it has also been found that:

1. The pressure within the lateral sinuses of the brain (measured by connecting a tube and manometer with the torcular Hero-



phili) varies absolutely with the intracranial pressure. It therefore exhibits pulsations which mirror precisely those observed in the cerebral pressure gauge.

2. Both these pressures passively follow changes in the pressure in the right auricle. They also run more or less parallel with changes in arterial pressure, and there is never any change in either of them which cannot be traced to some general circulatory condition.

The reason why the intracranial-venous and the intracranial (cerebral) pressures do not vary absolutely with the arterial is that they "are equal to the arterial pressure minus the unknown resistance which opposes the tension of the vascular walls on the arterial side"—(Leonard Hill). This elastic tension is so great that it reduces the pressure to millimeters of water instead of millimeters of mercury.

A few of the many experiments performed by Leonard Hill and others will serve to prove these far-reaching conclusions:

1. In asphyxia produced by cessation of the respiratory movements in a curarized animal, the cerebral venous pressure at first falls with fall in the systemic pressure and then rises as the arterial hypertension sets in. In the last stage, however, although the arterial pressure is quickly falling, the venous pressure rises and with it the cerebral venous pressure.

2. During administration of ether, alterations in cerebral pressure become marked only when there is extensive muscular movement or hyperpnœa. Chloroform, on the other hand, by acting more directly on the heart so as to produce a fall in arterial and a rise in venous pressure, causes at first a decided rise in cerebral pressure and later a fall following the development of decided arterial hypotension.

3. Amyl nitrite, injected into the jugular vein, causes at first a rise in venous pressure and therefore in cerebral pressure. Later, however, marked arterial hypotension develops, and the intracranial pressure declines.

4. During epileptic fits induced experimentally by excitation of the cortex, there is a rise in venous pressure and correspondingly in intracranial pressure. In the more violent convulsions produced by absinthe, there is very little change in systemic venous pressure, while the arterial pressure shows extreme variations, with which the intracranial pressure runs parallel. With adrenalin, where both arterial and venous systemic pressures rise enormously, there is of course a great rise in intracranial pressure and there is

never any local change in the latter which would indicate that this potent drug had locally caused these vessels to constrict.

5. The alterations in systemic pressure induced by the operation of the force of gravity and coming into play when the position of the body is changed, if not perfectly compensated for by constriction of the splanchnic area, will cause corresponding changes in the intracranial tensions. Under the influence of gravity, for example, the intracranial and the intracranial-venous pressures may fall below zero.

It is important to note here that the pressure of the cerebrospinal fluid does not absolutely correspond to the intracranial pressure, partly because this fluid is really a secretion produced by the choroid plexus, and partly because it is readily absorbed either by returning to the venous blood through the Pacchionian corpuscles or by leaking away through the spinal cord and nerve sheaths. As evidence accumulates, the significance of this fluid in a physical sense—that is, as a fluid which may become adapted in amount to accommodate the blood supply—becomes less and less insisted upon, its function being rather that of a nutritive or lubricating fluid.

The comparatively slight amount of extra room which can be provided in the cranial cavity by compression of the venules and capillaries has suggested to some writers that a self-strangulation of blood-flow might occur when the pressure suddenly rises in the basal and cerebral arteries. The increased pressure would be transmitted undiminished through the incompressible brain substance to the thin-walled vessels and compress them because of the lower pressure within. This is the truth but not the whole truth, for if these theorists had carried their reasoning a little further, they would have seen that any curtailment in blood flow through the venules and capillaries could only be transitory, since the compression will be overcome by the arrival of the pressure wave through the blood stream itself. For it is obvious that the arterial pressure transmitted directly must be greater than that pressure after it has overcome the tension of the arterial wall and is transmitted to the venules through the brain substance. Whenever this readjustment has occurred, the cerebral vessels become expanded to the greatest extent possible and they become virtually rigid tubes comparable with the rubber tube suspended in water in a closed flask, as in the scheme referred to at the beginning of the lecture.

These adjustments having been made, the only variation in

intracranial blood supply which can occur is one affecting the velocity of flow or if you prefer the term—the mass movement of the blood; the volume cannot change. After all, however, that is what is necessary to meet the demands for more blood, and the conceptions which have been formed by studies on expansible vascular areas, such as the kidney and spleen, that increased blood supply runs parallel with increased volume, do not apply.

That the mass movement of the blood in the cranium increases when the arterial pressure rises has been shown by direct experiment. Hill and Nabarro found it increased from two to six times during the convulsions produced by absinthe.

*Local readjustments of blood supply in different parts of the brain.*—Limited though any change in calibre of the cerebral arteries can be, it is nevertheless sufficient to make it possible that local variations in blood supply might occur as a result of active constriction or dilatation of the vessels. Just as the blood supply of a muscle or gland may be varied independently of any change in general blood pressure, by local changes in the calibre of its blood vessels, so might that of the brain be varied, and this might occur to a limited extent for the supply as a whole, as by constriction of the circle of Willis, or to a greater extent in one or other of the arteries which spring from the circle. By the latter adjustment a greater blood supply might be directed into an area which had become especially active, the flow to other relatively quiescent areas being meanwhile somewhat curtailed.

These possibilities raise the question as to whether there are functionally active vasomotor nerves to the cerebral vessels. Histologists have definitely demonstrated nerve fibres running on to the cerebral vessels, especially by the use of the *intra vitam* methylene blue method of staining (Huber, Hunter, etc.), but this does not of course necessarily indicate that the fibres normally cause the arterial walls to expand and contract. The only basis upon which such a claim could be put forth is an actual demonstration of changes in intracranial blood flow occurring independently of changes in systemic arterial or venous pressures.

Leonard Hill and Bayliss, and later Leonard Hill and Macleod, have most diligently sought for such evidence, but with entirely negative results. Records were taken of the intracranial pressure, the cerebral venous pressure and the pressure in the circle of Willis (by a cannula inserted in the peripheral end of the internal carotid artery), as well as the arterial and venous pressures in the systemic vessels (carotid and jugular). Since any vasomotor fibres must

presumably be derived from the vasomotor centres, and since these fibres must gain the cerebral vessels through the stellate ganglion and ultimately travel into the cranial cavity along the outer coats of the arteries, the above pressures were simultaneously observed before and during electrical stimulation at these places. It was found that any change that did occur could invariably be attributed to changes in the circulation as a whole; there was never any alteration in pressure locally in the brain for which the occurrence of local constriction or dilatation of the vessels had to be assumed.

Other observers have attempted to investigate the problem by measurement of the volume of blood leaving the brain, but with similarly negative results.

But an objection can be raised to these experiments on the ground that there might be feebly acting vasomotor influences, the effect of which would become entirely masked by the much more potent influence exerted on the blood-flow by changes in the circulation as a whole. As pointed out by Wiggers, the only way by which local changes in the blood flow through the intracranial vessels can be expected to reveal themselves is by measuring the entire outflow, a measurement which, however, it is impossible to make in an intact animal on account of the many pathways through which the venous blood can leave the skull. Measurement of the outflow by one of them does not by any means indicate the magnitude of total outflow. To overcome these difficulties, Wiggers proceeded to measure the outflow from all the cranial vessels of oxygenated Locke's solution perfused into the cerebral arteries under constant pressure. It was found that the otherwise constant rate of outflow became decidedly curtailed when adrenalin was added to the Locke's solution. If we assume that this drug acts only on arterial muscle having functionally active vasoconstrictor nerves, then the result would prove the presence of such fibres to the cerebral vessels, but even granted this, the result does not warrant the conclusion that, under normal conditions in the intact animal, such fibres display any activity. Wiggers does not claim that his results prove that a local vasomotor mechanism is important, but thinks that "they are favourable to the view that cerebral vaso-constrictor nerves are present".

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## INTRACRANIAL PRESSURE

BY W. F. HAMILTON, M.D.

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**I**NTRACRANIAL pressure has been defined as the pressure which the surface of the brain exerts against the walls of the cranium. The estimation or measurement of the degree of pressure under normal and abnormal conditions has occupied the attention of both physiologists and clinicians. Sir Leonard Hill, Kocher, Harvey, Cushing, and others have laid the foundations of our present knowledge of the subject, and their illuminating teachings have made clear the significance of intracranial pressure and indicated the lines of treatment of this very important condition.

Physiologists have shown that the normal intracranial pressure varies comparatively widely from zero to 50–60 m.m. of mercury, the average pressure under normal conditions being 100 to 130 m.m. of water. It is the same as the venous pressure in the skull, *i.e.*, the same as the pressure within cerebral veins and sinuses, and practically that of the cerebro-spinal fluid; its variations depend upon cardiac systole, the phase of respiration, posture, muscular effort, straining, fatigue, etc. It is of circulatory origin and is intimately related to general venous pressure and less so to arterial pressure. When the intracranial pressure is greatly increased and approaches that of arterial tension, then only is the general blood pressure increased as a result of primary intracranial changes. On the other hand, high general, *i.e.*, systemic arterial tension is not necessarily accompanied by increased intracranial tension.

The statement that intracranial pressure depends upon the circulation or is of circulatory origin is as true when applied to pathological conditions as when a physiological state is under discussion.

The important question for physicians and surgeons to answer is: "When does intracranial pressure become pathological?" On this point Hill's teaching is that "by no *physiological* means can

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intracranial pressure be *maintained* higher than cerebral venous pressure. It is, however, possible that a very sudden and abnormally high rise of arterial pressure should so expand the arteries at the base of the brain as to temporarily compress capillary areas and produce anæmia. Nevertheless, the effect can only be momentary and the circulation once more rights itself and the blood flow becomes increased in velocity."

When the intracranial pressure through any cause, examples of which may be indicated later, becomes (pathologically) greater than the pressure in the venous sinuses, *then the cerebral circulation is disordered*. Then begin venous stasis and cerebral anæmia, which are productive of the signs and symptoms characteristic of increased intracranial pressure.

There is but one vascular system, the circulatory system within the cranium. We may, however, consider this system in relation to intracranial pressure as divided into two systems, the venous and the capillaries system, and the arterial system, each without "functionally active" vasomotor nerves. The ventricles and subarachnoid spaces and their communicating ways may be regarded as forming yet another system of vessels, through which both normally and pathologically fluid circulates.

Thus we may consider three systems within the cranium, each containing fluid—three vascular systems if you will, the cerebral veins and sinuses and capillaries—with venous blood; the capillaries and arteries with arterial blood, and the ventricles with their interventricular ways and foramina and meningeal spaces, through which circulates the cerebro-spinal fluid. The behaviour, or shall we say, the disposition of the fluid in one or another, or at times in all of these systems determines intracranial pressure. Hill's statement that intracranial pressure "is of purely circulatory origin" applies alike in a physiological and in a pathological sense.

The part played by these three fluids or the distribution of them, determines in many instances the degree of intracranial pressure. While Hill maintains that no pathological increase of cerebral tension can be transmitted by the cerebro-spinal fluid, because this fluid can never be retained in meningeal spaces at a tension higher than that of the cerebral veins, yet this view does not appear to take account of the condition which obtains when the intraventricular pressure is raised by blocking of the outlets, by tumour or inflammatory exudate, nor does it regard the effects that seem possible as a result of an abnormally rapid secretion of this fluid. Again it has been stated (on physiological grounds un-

doubtedly) that the amount of cerebro-spinal fluid is far too small to make much difference in intracranial pressure by shifting its position or when it is expressed from the space within the cranium. Here again we would urge that a correct estimate of the normal amount of this secretion is almost impossible, while under various abnormal conditions an enormous amount of cerebro-spinal fluid has been demonstrated as secreted in a day. The brain of a dog, *e.g.*, gave 240 c.c. in twenty-four hours and from certain observations it would appear that under pathological conditions at least, the cerebro-spinal fluid may play a most important part in bringing about changes in intracranial pressure.

Before entering on the discussion of the symptoms of increased intracranial pressure, it seems well to point out that these vary widely according to whether the pressure has *developed acutely or slowly*. Even though the brain is contained in an unyielding case, yet it shows a surprising degree of adaptation. Should the intracranial pressure become suddenly increased, the signs are pronounced from the beginning. On the other hand, if the change is brought about slowly, a high degree of pressure may be found with but little disturbance, but scant evidence of its existence being discoverable save only by a searching examination. The symptoms in respect of their acuteness and gravity bear comparison very well with those found in the chest when the whole of one lung is suddenly put out of commission by pneumothorax—the lung in a state of collapse, the mediastinum displaced, pain and breathlessness marked, and death not infrequently supervening in such a case within a few hours. On the other hand, in respect of their mildness and apparent lightness, the symptoms bear comparison with those of pleurisy with effusion increasing slowly up to the second rib, the mediastinum displaced, and yet only but slight dyspnoea on exertion. In both cases thus developed, danger is imminent, though not apparent, the margin of safety narrow, the slightest changes may bring about a fatal ending. They bear comparison in one other respect—that a fatal issue may supervene due to circulatory changes—œdema of the brain, œdema of the lungs.

As examples of the acute type, intracranial hæmorrhage, and trauma, may be mentioned, while intracranial tumours, and slowly developing hydrocephalus, afford examples of the chronic type. *The changes following naturally upon an increase of intracranial pressure*, due to the diminution of space from hæmorrhage or new growth or trauma (that pressure which the surface of the brain

makes upon the walls of the cranium or that pressure which any intervening substance, blood, exudate, effusion, tumour—transmits to the brain by reason of its contact within the walls of the cranium limiting, by its bulk, the normal space for the brain) would be the recession of the brain from that point so far as tentorium cerebri and the falciform ligament would admit, and an expression from its various circulatory systems of as much fluid as possible. Generally speaking, the changes are in proportion to the degree of pressure inducing changes in cerebro-spinal fluid, veins, capillaries and finally in arteries themselves; these fluids involving first the ventricular fluid, and compressing to some extent the veins and the venous radicles. The cortex may first give evidence of the pressure, while bulbar signs and symptoms come later, all depending, of course, on the site of the lesion.

The signs and symptoms of increased intracranial pressure vary, not only according to the rate at which the pressure is raised, but also according to the degree of pressure.

First, the displacement of the cerebro-spinal fluid and narrowing of venous channels compensate or make room for the increased tension. Von Schulten points out that compression representing 5 per cent. or 6 per cent. of brain volume in rabbits caused narrowing of arteries, dilatation of veins, and projection of the floor of the fundus oculi. Then, should the pressure increase so that it is greater than the pressure in the cerebral veins, venous stasis is induced. Brain function is disturbed and pain complained of. The signs are referable to the dura, the cortex and the special senses—as shown by headache, restlessness, vertigo, delirium. Slight bulbar signs may supervene, *e.g.*, slowing of pulse, a rise in the general blood pressure, and altered respiration. The veins of the optic papilla may become distended.

A still greater degree of intracranial pressure, which expresses the blood from the capillaries may arise and cerebral anæmia results. The signs of bulbar involvement may now supervene. The respiratory and vasomotor and vagus or medullary centres are involved. The breathing, Nature's protective mechanism to keep the vital centres nourished, becomes irregular; different types have been described (Cheyne Stokes, Biots, etc.). The general arterial blood pressure now increases to a high degree. The pulse is slow, the pupils are now large, now small; the sensorium is now cloudy, now less so, in a word, restlessness and stupor, a state of alternating irritability and non-irritability of centres is clearly demonstrated.



When the intracranial pressure increases, or is long maintained, the centres tire, paralytic signs supervene, or the centers, no longer irritable, fail, and blood pressure falls, coma deepens, the respiration fails and death follows. Such may be course of heightened intracranial pressure.

The outstanding symptoms then developing, as a result of increased intracranial pressure, are explained altogether upon the changes induced in the vessels. As stated in the beginning, "venous stasis" and capillary anæmia, whether induced by a single forceful blow, a displacement of the medulla against the skull, a massive hæmorrhage, meningitis, as a rapidly increasing internal hydrocephalus, may be regarded as explaining all the phenomena of this important and dangerous condition.

*The value of eye ground examination in showing increased intracranial pressure.*

Increased emphasis is being placed upon the importance of eye ground examination in all cases suspected of increased intracranial pressure. Clinically and experimentally, changes in the fundus are common, ranging from engorgement of veins and slight blurring of the disc to papillo-cedema and choked disc. The condition is now generally ascribed to a mechanical cause. This view is supported by the experimental work. The cerebro-spinal fluid, under tension, finds its way into the optic nerve sheath, exerting pressure upon the vessels of the optic nerve. Bordley, observing the changes in the retinal vessels, while Cushing tapped the ventricles distended on account of meningitis, saw the tortuous veins in the eye become less distended and the arteries become larger as the pressure on the ventricles was relieved. Cushing remarks that observation of the retinal vessels is almost, if not quite, as valuable in observing the cerebral vessel pressure as the glass window in the skull.

Kearney points out that on examining the fundi of 1,400 children with spastic paralysis, which in 70 per cent. of cases, is due to intracranial hæmorrhage at birth, three hundred, or about one in five, showed distinct cedematous changes in the fundi, due to increased intracranial pressure.

In observing many cases in the Royal Victoria Hospital, one concludes that time is a factor in the development of fundus signs, for in nine cases of meningitis, where the intracranial tension as indicated by lumbar puncture was *high*, in only two cases were any changes (and these but slight) noted in the fundus. These patients had been ill from four to eight weeks. In eighteen intra-

cranial tumours of much longer duration (five cerebellar and thirteen elsewhere), the eye grounds were unchanged in three only. Doubtless a mild degree of internal hydrocephalus had developed during the months of illness.

One might add indefinitely to the evidence setting forth the importance of this sign in pressure cases. Enough has been said, however, to make it plain that ophthalmoscopic examinations should be made early and often whenever increased pressure is suspected.

*Intracranial fluid or cerebro-spinal fluid.* Its relation to intracranial pressure and the significance of lumbar puncture.

It is now generally agreed that the cerebro-spinal fluid is secreted by the choroid plexuses, and augmented by the waste fluid products of nerve cell activity. While the quantity under physiological conditions may be minimal, as pointed out by Hill, yet the amount undoubtedly varies under varied conditions. Secreted by the choroid plexuses the cerebro-spinal fluid is absorbed into the venous system, and, according to a good authority, this process repeats itself every four to six hours, thus demonstrating a fairly rapid movement out of and into the vascular system.

For the topic before us to-day, we are concerned, however, only with the question as to the pressure signs available from lumbar puncture. Some men go so far as to say that lumbar puncture is the most valuable aid we have to-day in the diagnosis of the degree of intracranial pressure.

While admitting the truthfulness of this claim in many cases, we must not forget that the correct estimation of intracranial pressure by this means depends upon the *free communication* of the subarachnoid space in the lumbar region with the cranial ventricles, a condition often absent. Then the character of the fluid may appreciably alter the pressure signs, *e.g.*, a fluid rich in cells, the turbid fluid of cerebro-spinal meningitis. Nor is lumbar puncture free from danger. In long standing intercranial pressure cases, in shock, in tumour of the brain, especially those beneath the tentorium cerebri, the procedure should be cautiously undertaken and carefully carried out. Nausea, vomiting, and headache sometimes follow the operation.

The relation of intracranial pressure to cerebral hæmorrhages, traumatic conditions, hydrocephalus and tumours will be discussed in detail by Dr. Garrow. A few observations, however, regarding intracranial tumours may be made in passing.

While it might appear reasonable that the space which a

tumour takes up in the cranium would determine its influence on intracranial pressure, yet this is not the case. Often the brain substance is destroyed as the new growth progresses, and thus space is not encroached upon. As already pointed out, of far more importance as symptom-producing causes are the changes in the circulation induced by the tumour, anæmia, thrombosis, venous stasis, internal hydrocephalus and cerebral œdema, by which sleeping states, convulsions, paralysis, intracranial pressure signs may be explained.

The cardinal or the typical features of intracranial tumour have long since been enumerated as headache, vomiting and optic neuritis, three prominent characteristic pressure symptoms. It has also been taught that along with these symptoms there is an increase in the arterial blood pressure. Following this matter out over several years, one fails to find evidence in support of this view regarding general arterial pressure. From a considerable number of case reports gone over recently in the Royal Victoria Hospital, in which a diagnosis of cerebral tumour was made, those whose ages varied from a few years to fifty years, no blood pressure was found beyond 130 systolic phase, while the brain often bulged in operation, and the cerebro-spinal fluid showed a considerable degree of heightened pressure. It may also be stated that on two or three occasions, not included in this series, there was found a sub-tentorial tumour with the same degree of blood pressure. It is quite different, however, with the fundi. Œdema, optic neuritis, venous engorgement, and optic atrophy, are the terms describing the greater number of fundal conditions found in these cases. In a group of cases of meningitis whose duration—of course—was naturally much shorter than that of tumour, optic nerve involvement was rare, as already pointed out.

Increased intracranial pressure serves to explain more and more the symptoms associated with a large number of diseases, *e.g.*, the acute infectious diseases, and from the evidence constantly increasing, it seems probable that the quantity of cerebro-spinal fluid would explain at least a few of these symptoms. The work of Dixon and Halliburton, in 1913, showed that alterations in cerebro-spinal fluid exerted a marked action on cerebro-venous pressure, and established the fact that increased secretion of the fluid resulted in definite changes in its pressure. They are inclined to believe that a deficiency of oxygen or an excess of carbon dioxide in the blood is the greatest factor in stimulating the secretion of the cerebro-spinal fluid. The good results following upon lumbar

puncture (even decompressive operations in cerebral oedema Cushing, Rawlings), would favour the view that the cerebro-spinal fluid, under pressure, is at all events an important factor in the cause of many of the symptoms—headache, delirium, convulsions, dizziness, etc.

In 1908 Cushing concluded one of his papers by saying that in view of the marked improvement after cerebral decompression in nephritis, this case adds further evidence to support the view that cerebral symptoms of uræmia are largely due to pressure from oedema of the cerebral tissue (*Am. Journ. Med. Science*, 1908). Severe headache and vomiting late in pregnancy, with head retracted and sleeplessness, have been relieved by the withdrawal of sterile cerebro-spinal fluid under great pressure (Gray, *Lancet*, November 4th, 1916).

Delirium, in seven severe cases of pneumonia under treatment by Musser and Hafford, was promptly relieved by lumbar puncture (*Am. Journ. Med.*, October 5th, 1917).

Claude and Meuriot relieved all the signs and symptoms of cerebro-spinal hypertension, following a bruise in the neck, by repeated lumbar punctures. *Le Progrès Medical*, 1916.

Mingazline (Il. *Políclinico*, July, 1917), advocates lumbar puncture in severe paroxysmal headache, with almost uniformly good results.

Rawlings (*B. M. J.*, May, 1918) claims that by lumbar puncture excess of cerebro-spinal fluid is demonstrated in cerebral oedema, seen in case of heat stroke, for which, in several instances, he has done a decompression operation by opening the cranium, with most satisfactory results.

#### TREATMENT

A prospective field for therapeutics is opening up as one learns more of the source and the agents which influence the secretion of the cerebro-spinal fluid. Generally speaking, however, it appears that there is but little that can be done by the internist beyond the use of lumbar puncture. Even this has a limited sphere of usefulness up to the present. It seems, however, that this method must become increasingly useful, particularly in cases of meningitis of the serous type, in oedema of the brain, from whatever cause, attention being given, of course, to this condition if an intracranial tumour complicates the case; in toxæmia such as uræmia or alcoholism,



or plumbism, not to speak of those essential headaches, so distressing and so intractable.

It must be admitted by all that the more one studies the subject, the greater is the promise which surgery gives for the relief, both in anticipating and in the actual crisis, of increased intracranial pressure.

#### SUMMARY

1. Intracranial pressure signs and symptoms depend upon the circulation in the brain.

2. Venous stasis and cerebral anæmia best explain these signs and symptoms.

3. The diagnosis in the less pronounced cases depends upon

- (a) general symptoms;
- (b) eye ground changes;
- (c) lumbar puncture.

4. It would appear in a certain number of instances—a number increasing with the number of observations—that the cerebrospinal fluid, without developing internal hydrocephalus, may account for many symptoms.

5. In the non-inflammatory cases, much relief is afforded by lumbar puncture.

## THE SURGICAL RELIEF OF INCREASED INTRACRANIAL PRESSURE

BY A. E. GARROW, M.D.

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**I**NCREASED intracranial tension, whether produced slowly or suddenly—the result of trauma, of new growth, of inflammation or of some congenital deformity, gives rise to circulatory disturbances in the brain. Slight increase of tension causes venous congestion, increasing in severity and extent as the pressure rises. Irritative signs and symptoms may occur when this disturbance affects the non-silent areas of the brain. A still higher degree of intracranial pressure leads to cerebral anæmia, due to compression of the capillaries, with complete loss of function in the area of the brain involved. The blood in the veins is unable to back up into the capillaries or to escape into the sinuses which are narrowed and compressed.

Increased intracranial tension may remain more or less localized, or it may rapidly or slowly become general. Localized pressure is the result of some local compression force, such as a depressed fracture, extradural hæmorrhage, etc. The anatomical arrangement of the falx cerebri and the tentorium cerebelli not only gives support to the contiguous brain surfaces, but they play an important part in localizing increased tension to the lobe or area primarily involved. This protecting influence is especially true of the tentorium, in that it guards the vital centres in the medulla from supratentorial encroachment in the cranial cavity.

General pressure, on the other hand, produced by subdural hæmorrhage, or acute obstructive hydrocephalus, etc., soon gives rise to the major signs of increased intracranial tension, signs that the medullary centres are being interfered with.

The normal intracranial pressure is that of the veins and of the cerebro-spinal fluid. Cushing has demonstrated that the cranial cavity can harbour a foreign body one-tenth to one-eighth the size of the brain without producing the major signs of cerebral compres-

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Being part of a symposium given at the Medical Week at Hamilton, May 23rd, 1918.

sion. This is due to the gradual increase of the body in a part of the cranial cavity which does not interfere with the escape or rapid absorption of cerebro-spinal fluid. On the other hand, a small subtentorial growth obstructing the aqueduct of Sylvius may give rise to a very rapid increase in tension. Sudden compression, on the other hand, such as is produced by deformation of the skull—the result of a severe blow on the head—causes a sudden increase of intracranial tension with capillary anæmia, involving chiefly the supratentorial region. This condition we call concussion. The effect of compression applied so suddenly gives no time for cerebro-spinal fluid to escape or for the venous outlets to become narrow, to compensate for the sudden diminution of the cranial capacity, so the rapidly developed tension applied to the solid and fluid cranial contents affects the capillaries chiefly. This anæmia mainly involves the supratentorial capillaries, but when very severe force has been applied the medullary centres may be equally involved and death from concussion takes place.

Trauma may give rise to temporary compressing effects as in simple concussion, from which the circulation of the brain may sooner or later recover, or it may produce permanent compression (until relieved by surgical treatment) in different ways, viz.: depressed fractures (extradural, subdural), pia-arachnoid hæmorrhages, contusion and laceration of the brain tissue with associated intracerebral hæmorrhage, and later on encephalitis and œdema of the brain. Each of these compressing factors disturb the cerebral circulation and produce venous congestion, capillary anæmia and an accumulation of fluid in the perivascular spaces, and arachnoid tissue—œdema of the brain. This latter condition leads to further venous congestion and still further œdema, so that a vicious cycle is established.

Normally the perivascular spaces drain their fluid into the sub-arachnoid tissue to mingle with the cerebro-spinal fluid secreted by the choroid plexuses. This fluid escapes from the ventricular system through the foramina of Majendie and Luschka to fill the various cisternæ situated at the base of the brain, and the cerebro subarachnoid tissue, from which it is absorbed largely by the venous sinuses. Anything which interferes with the escape of fluid from the ventricles, or prevents its flow through the cisternæ and sub-arachnoid tissue and its subsequent absorption and escape from the cranial cavity through the sinuses, increases the intracranial tension.

Retention within the ventricular system from any cause gives rise to obstructive hydrocephalus, the signs and symptoms of which

vary according to the age and condition of the cranial sutures. In the unyielding skull this form may rapidly produce the major symptoms of cerebral compression.

In the communicating variety of hydrocephalus, where there is either an increased secretion of cerebro-spinal fluid or a diminished absorption, due to obliteration of the cisternæ from inflammatory exudate or organizing blood clot, etc., the result on the intracranial tension is similar to that in the obstructive variety.

The experimental studies on cerebral compression, and on the secretion and absorption of cerebro-spinal fluid and the interrelation of these to blood pressure, by Leonard Hill, Horsley, Halliburton, Cushing, Frazier, Mott, Weed, Dandy, Blackfan and many others, have added in recent years much scientific knowledge to what had been taught by the pioneers in this subject.

Their labours have already yielded wonderful practical results in dealing with increased intracranial tension, arising from trauma, new growth, inflammation or congenital deformity.

Phenolsulphonaphthalein injections given by lumbar puncture, or by intraventricular injections as taught by Blackfan and Dandy, can differentiate obstructive from communicating types of hydrocephalus, and further, by the examination of the urine, whether in the latter form, the disturbance is due to hypersecretion or to diminished absorption of cerebro-spinal fluid. Their studies have at least shown why callosal puncture, drainage of the ventricle and other methods of treating hydrocephalus have failed to give satisfactory results in the past.

Frazier and Peet have demonstrated that many substances may have some influence in increasing the flow of cerebro-spinal fluid, but that up to the present, one alone seems to have the power of diminishing choroid secretion, viz.: thyroid extract. Ligation of both carotid arteries fails to diminish cerebro-spinal fluid secretion and hence this procedure has no place in the treatment of hydrocephalus.

Headache, vertigo, vomiting, drowsiness and mental lethargy are early signs of increase of intracranial tension. These evidences of venous congestion are very often and quite early reflected on the eye grounds. Ophthalmoscopic examination of the retina should form a routine part of the examination in every case of suspected cerebral compression. In local compression, becoming widespread or general, a distinct difference in the severity of the venous engorgement and stasis in the retinal vessels in each eye may be made out by the oculist, whose services and advice should always be obtained.



Horsley, years ago, drew attention to the importance of ocular examination in cerebral compression and the urgent necessity of saving vision by a decompression operation, since papilloedema and optic atrophy due solely in these cases to venous and lymph stasis, if unrelieved, result in permanent blindness.

But papilloedema may be absent in tumours, traumatic lesions, and particularly in marked oedema of the brain, so frequently seen after or complicating traumatic lesions, and as recently reported by Rawlings in "heat effects", in which the wet brain was demonstrated by subtemporal decompression and opening the dura, although in some of his cases lumbar puncture failed to reveal excess of fluid or high tension. Rawlings thought this was due to some interference with the normal channels of communication connecting the subarachnoid tissue of the brain and that of the spinal cord.

Every surgeon has noted the uneventful convalescence following compound fractures of the skull, in which free bleeding and oozing of clear fluid have occurred, particularly the absence of persistent post-traumatic headache, dizziness and mental lethargy, inability to concentrate attention, loss of memory: whereas simple fractures with concussion, and it may be with slight evidences of increased intracranial tension, treated in the usual way by rest, careful dieting and an ice bag, have been followed by annoying and often persistent headache, nausea, vomiting, etc., etc.

Is it possible that operative treatment would benefit such cases? And are these late symptoms due to persistent disturbance in the circulatory system and in the escape of cerebro-spinal fluid? Does oedema of the brain give rise to organic changes in the perivascular spaces and in the avenues of escape of the cerebro-spinal fluid?

The major symptoms of cerebral compression arise when the intracranial tension begins to approach that of the blood pressure. These symptoms are a gradually increasing blood pressure, with disturbances in respiration of the Cheyne-Stokes type, and less constantly, though usually present, a slowing of the pulse.

Cushing has shown that these symptoms depend upon capillary anæmia of the medullary centres, the result of which is to stimulate the vasomotor nuclei, causing a rise in blood pressure which overcomes the threatened or actual anæmia in the bulb. If the vasomotor centre, either from exhaustion or protracted anæmia, fails to respond, respiration suddenly stops, but the heart continues to beat for hours if artificial respiration is maintained.

A steadily rising blood pressure, with disturbance of the respiratory centre and slow pulse, demands immediate surgical relief.

In this advanced stage decompression may not always be successful even when blood enters the capillaries, because the vasomotor centre has been exhausted and will not respond to the return flow of blood.

The surgeon must keep these physiological and pathological data in mind when called upon to give relief to increased intracranial tension. As Elsberg says, "I believe that in our operations for cerebral and cerebellar decompression we have given too much thought to the method of the operation and too little attention to the principles upon which such decompression should be based."

Nature has demonstrated for ages how increased tension can be partly relieved in the infant with hydrocephalus. The removal of a large or small portion of the skull and radially cutting the dura imitate this procedure in the unyielding adult skull. Every cerebral tumour is not necessarily associated with marked increase in the intracranial pressure. Its presence is shown chiefly by the local symptoms or by disturbances of cerebral or cerebellar function. On the other hand the early, if not the earliest, sign of a tumour may be those associated with gradually but rapidly increasing general tension due to obstructed outflow from the ventricles. Whatever tension existed in the first case could only be relieved by removal of the growth or by enlarging the brain space. A decompression in the second case, if the tumour is not operable, would not only be useless but positively harmful, whereas a permanent fistula between the ventricles and subarachnoid tissue would or might be followed by temporary or permanent relief.

In many instances decompression is only a palliative procedure to relieve headache, vomiting, and above all, optic neuritis, just as a gastro-jejunostomy relieves the symptoms of pyloric obstruction of cancerous origin.

Elsberg gives the following indications and contra indications for decompressive procedure:

1. In expanding lesions of the brain, where localization is impossible, but the sufferings of the patient are great and the danger of blindness imminent.
2. When the lesion has been localized, but from its nature or location cannot be removed, and is causing marked increase of intracranial pressure.
3. When the symptoms are due to a congenital or obstructive hydrocephalus.
4. Acute intracranial conditions, associated with œdema of the brain.

He does not operate in cases with extensive paralysis or where the patient is already blind, but has few or no other symptoms, nor does he think much benefit accrues in nephritis with oedema of the brain and optic neuritis. He refers to Kocher's recommendation of a decompressive craniotomy over the motor area for epilepsy, but does not think the operation has been of value.

The methods at our disposal to relieve increased tension are:

1. Craniotomy, which may be a so-called decompressive craniotomy, or it may call for the elevation of depressed bone; the removal of extradural or subdural clot or of fluid blood, the removal of intracerebral blood clot as in apoplexy; or even from the ventricle; or for the relief of an oedematous brain.
2. Lumbar puncture.
3. Puncture of the ventricles.
4. Puncture of the corpus callosum.
5. Sellar decompression.

(1) Lumbar puncture may relieve intracranial tension. The normal pressure varies from 60 m.m. to 100 m.m. of water or from 5 m.m. to 7.3 m.m. of Hg. As already stated, Rawlings and others have found a high intracranial with a low spinal pressure.

Repeated aspirations have been employed to relieve hydrocephalus. It should never be used to relieve tension in subtentorial tumours unless a wide opening exists in the occipital bone, on account of the danger of herniation of the cerebellum into the foramen magnum and sudden medullary death (Elsberg).

Willems and Albert (*Int. Abst. Surgery*, Feb., 1918, p. 119) recommend it in concussion and in basal fractures to relieve headache, vertigo and vomiting; and repeated tapplings to relieve cerebral hernia.

Frazier and others find its chief value in reducing intracranial pressure after craniotomy, but before opening the dura when tension is high, and also in cerebral operations when the protruding brain renders closure of the dura difficult or impossible.

(2) Ventricular puncture is easily performed in infants through the lateral angle of the anterior fontanelle. Permanent drainage has been more or less successfully carried out by means of silkworm gut, metal tubes and strands of silk, one end of the strand or tube lying in the ventricle and the other in the subdural space. Ventricular puncture is of great value in relieving tension during the progress of an intracranial operation.

Keen chooses a point one and one-quarter inches above and

behind the upper margin of the auditory meatus. At this point a small button of bone is removed and a slit made in the dura. A blunt needle is directed towards a point two and one-half inches above the external meatus of the opposite side. The ventricle is usually entered at a depth of two and one-half to three inches in this line.

Elsberg, however, recommends Kocher's method because the depth of the ventricle is greater than the width. The site chosen is that employed in performing puncture of the corpus callosum, and the needle is directed downwards and slightly backwards, and enters the ventricle usually at a depth of from 5 to 6 c.m.

(3) Puncture of the corpus callosum was devised by Anton and von Brahmman in 1908, and was indicated, they believed, in internal hydrocephalus (obstructive), in tumours with associated hydrocephalus, either as a preliminary step to relieve tension before removing an operable growth or for permanent drainage in inoperable tumours.

Choose a point 1 to 2 c.m. behind the coronary suture and the same distance from the mid line. Incise the scalp and remove a small button of bone. Open the dura just outside the lateral margin of the superior longitudinal sinus. A flexible canula with one or two lateral openings and a slightly bulbous end is suitably bent to facilitate its introduction into the superior longitudinal fissure along the side of the falx cerebri. When the canula is arrested by the corpus callosum the stilet, which is used with the canula, is withdrawn and the instrument is forced through the corpus. Successful puncture is evidenced by a flow of clear fluid. Before withdrawing the instrument, the opening in the roof of the ventricle is enlarged antero-posteriorly (not laterally) by bluntly tearing through the fibres of the corpus. On withdrawing the instrument, suture the dura and scalp separately.

The permanence of this fistula depends upon the increased ventricular tension over that in the subarachnoid tissue.

#### DECOMPRESSIVE CRANIOTOMY

This is employed to relieve pressure in inoperable tumours and in growths which cannot be located. Sufficient bone must be removed to relieve the tension, and in all cases the dura should be radially incised or excised. Callosal puncture, in many of these cases, has obviated the great disfigurement from the resulting hernia, to say nothing of the post-operative paralysis which not infrequently



follow an extensive decompressive operation. As already stated, Frazier has emphasized the importance of recognizing obstructive hydrocephalus as the chief factor in producing tension in many of these cases, and of the value of callosal or ventricular puncture in relieving it.

When decompression is necessary, it should be performed over a silent area and the protruding brain should be protected by muscle and fascia.

Cushing's subtemporal decompression to relieve pressure in the cerebral hemispheres, and suboccipital decompression to relieve tension below the tentorium, are the methods of choice.

Neither time nor the requirements of this contribution allow for a description of the surgical treatment of depressed fractures, epidural, subdural, pia-arachnoid or intracerebral hæmorrhage, although each of these conditions, singly or in combination, accounts for the initial disturbance which gives rise to increased tension. Adequate treatment calls for the elevation of the depressed bone, the arrest of bleeding, the removal of fluid blood or blood clot from the epidural and subdural areas and, if it can be located, from the interior of the brain. Ventricular puncture will reveal blood in the ventricles when present.

Sinoventricular puncture, as devised by Dandy experimentally, so far as I know, has not been subjected to the test of clinical experience.

Haynes, in 1912, advised drainage of the cisterna magna for the surgical treatment of meningitis, and in 1913 proposed and carried out drainage of the cisterna magna into the occipital sinus by means of a small rubber tube, for hydrocephalus.

Payr in 1908 announced a method of draining the lateral ventricle, in obstructive hydrocephalus, into the superior longitudinal sinus by means of a portion of the long saphenous vein.

Each of these three methods depends upon the greater pressure and lower specific gravity of the cerebro-spinal fluid as compared with the blood in the sinuses, so that when an artificial communication is made, there seems to be no tendency for blood to flow from the sinuses either into the ventricle or into the subarachnoid space.

Sellar decompression for the relief of pressure in new growth of the hypophysis is more or less in its developmental stage. Kana-vel, Lewis, Mixter, Halsted, Cushing, and Hirsch have devised and perfected the nasal route of approach through the sphenoid.

Frazier and Elsberg have chosen the transfrontal operation. Elsberg thinks sellar decompression should be done by a skilled

rhinologist, who should have no difficulty in opening the sphenoidal cells under local anæsthesia and removing the floor of the sella turcica.

Cystic collections of fluid outside of the brain are rare and are usually found in the posterior cranial fossa. Some of these are undoubtedly collections of fluid in one of the basal cisternæ.

Krause has applied the term "*arachnitis adhæsiva circumscripta*" as a proper and descriptive name for this condition in the cranial cavity (page 726, Vol. II).

Such collections give rise to compression symptoms and have been mistaken for tumours, indeed most cases recorded have been diagnosed at the operating table.

Incision with or without drainage through the suboccipital route has given satisfactory results.

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EARLY in April a splendid club house for colonial and United States' nurses was opened in Rutland Square, Edinburgh. It is designed as a rest-house for those who are released for a while from their arduous duties in France. The building was originally a club house for men of the overseas forces, and so completely did the house fulfil its mission, that it was soon impossible to accommodate all the applicants. On moving the men's club to new quarters, the Rutland Square house was fitted up by a citizen interested in providing comfortable quarters for visiting nurses. It is expected that the owners of many beautiful Scottish estates will supplement the hospitality of the club house by invitations to their country homes. The Edinburgh branch of the Victoria League is responsible for the club house, and the Marchioness of Linlithgow is president of the branch.

## ACUTE ENDO-CARDITIS IN PREGNANCY

BY G. STEWART CAMERON

*Peterboro, Ontario*

THE somewhat unusual course of illness and death of a pregnant woman under my care a short time ago prompted me to submit to you a history of the case, together with such literature bearing upon it as I have been able to secure.

*Past History.* Mrs. A. B., primipara, age thirty-one, farmer's wife, married one year, past history is negative. From a careful questioning of the patient and her friends, I have not been able to find any history of rheumatism, typhoid fever, or any septic trouble which might be accompanied with an involvement of the endo-cardium. As the patient expressed it herself, "she was never ill a day in her life."

*Family History.* The family history is also negative.

*Present Condition.* On February 2nd, the patient was taken ill with rather indefinite pains in her back and limbs, together with some slight chills, but as the whole countryside was epidemic with the usual winter influenza, little attention was paid to the condition. About one o'clock on the morning of February 3rd, the patient had a very pronounced chill, and when I saw her a couple of hours later, her temperature was 103° and pulse 120. I saw her the next forenoon when her temperature was down to 100°, and she appeared somewhat recovered from her experience of the night before. We brought her into hospital that afternoon, when a careful physical examination was made, and the following noted:

The patient looked pale and tired. She was moderately well nourished. A marked pyorrhea existed, involving all her teeth. Tonsils appeared normal. Examination of the heart and lungs revealed nothing abnormal. The patient was sixteen weeks pregnant. The urine was normal in quantity and on chemical examination. The bowels had been persistently constipated. The patient's temperature at this time was 98° and pulse 90. If it had not been for the peculiarly anxious mental condition of the patient, we would have been strongly of the opinion that her acute condition had subsided.

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Read before the Canadian Medical Association, Montreal, June, 1917.]

The following forenoon the patient had a most violent chill, followed by a rise of temperature to 103.2-5 and pulse 130, lasting nearly one hour, together with very marked prostration and breathlessness. The pulse and temperature gradually subsided, and in eight hours reached 98° and pulse 90. During these attacks the patient became delirious, and frequent involuntary passage of both urine and faeces occurred. Examination of the blood at this time showed red cells 3,500,000 and white cells 18,500. Examination of catheterized specimen showed the urine again negative, both chemically and microscopically; examination of the vaginal secretion showed absence of any specific organism. The chills were repeated about every twenty-four to thirty hours, while the temperature and pulse in the interval varied from 96° to 100. Repeated white blood counts varied from 18,500 to 21,000, and repeated urinary examinations showed an absence of pus, albumen, or casts. A blood culture was made, but we do not care to refer to the report as contamination was subsequently advised.

On the fourth day after entering the hospital, a soft blowing murmur developed at the cardiac apex, and by the fifth day the murmurs were heard at the pulmonary and aortic orifices. The blood pressure taken at this time showed a systolic of 120 mm., and diastolic of 90 mm. On the fourth day 50 c.c. of polyvalent serum was given and repeated on the fifth day. Outside of the fact that the white blood count dropped to 9,500, no improvement was noted in the case. The serum was repeated on the eighth and ninth day, but the patient steadily grew worse. No further serum was used. The patient took nourishment pretty freely, but notwithstanding, emaciation was rapid and constant, and the delirium gradually increased. These symptoms continued until February 18th, when the patient suddenly aborted. The act was accompanied with little perceptible disturbance to the patient. Shortly after this she lapsed into unconsciousness, gradually grew weaker, and died three days later, having been ill in all nineteen days.

From the clinical evidence in this case, we made a diagnosis of acute primary endo-carditis, or the so-called malignant endo-carditis. While the disease is somewhat unusual in pregnancy, there was another feature which appeared to us as equally unusual, and that was the possible mode of infection. We think there are three possible sources.

First: As a result of influenza.

Second: From the intestinal tract.

Third: From the pyorrhea.



The patient was undoubtedly exposed to influenza, but as she presented no symptoms prior to the onset of her fatal illness, we think we can reasonably exclude this disease.

Infection through the intestinal tract we know to be a common source, and we think can reasonably be considered here, as the patient gives a history of marked and persistent constipation previous to the onset of this attack.

Outside the specific intestinal infections, such as typhoid, the commonest infection of the alimentary canal is the colon bacillus, but so far as we know it shows an affinity for the genito-urinary rather than the cardio-vascular system, so I think, we can, clinically at least, exclude the intestines as a probable avenue through which infection entered.

To my mind the mouth offers a very apparent and probable portal of entrance for the infecting organism. This being the case, our attention is directed to the association of oral infections with pregnancy. I use the word association advisedly, because it may subsequently be shown that these septic areas are only a coincident of pregnancy, and in no way directly connected with it, but it seems to me that, in the light of our present knowledge, there is sufficient evidence to direct our attention to the mouth of a pregnant woman as a reasonable source of trouble.

It is a well-known fact that caries of the teeth and inflammatory conditions of the gums and mouth are frequent causes of discomfort and even illnesses in the pregnant state. This being the case, it would appear that there might be a greater possibility of infection through the mouth of the pregnant than the non-pregnant.

When we turn to consult the literature bearing on cardiac infection we find that it is extremely limited. So far as the ordinary text-books are concerned, very little attention is given to the subject, and this indicates that the disease is very rare or else it is not considered as a separate pathological condition.

Almost all the articles to which we have had access speak of the lesion as having existed previous to pregnancy, the result of some well marked infection, which became manifest during gestation or the puerperium. It is possible in the case cited we may have had some latent valvular infection which became active in pregnancy, but in the absence of any previous illnesses or symptoms pointing to the endocardium, we think that there is reasonable evidence to believe this infection originated during gestation.

Tuszki<sup>1</sup> speaks of diseases of the heart arising during pregnancy from influenza, typhoid, gonorrhœa, etc., the cardiac lesion in

this case being a direct infection from these specific organisms, and might be from an acute attack occurring either in pregnancy or previously. If it were a previous attack, pregnancy would appear to cause a lighting up of the old lesion.

Durr<sup>2</sup> of the Berlin Charité Hospital is quoted as saying that in 40 per cent. of the cases of endo-carditis seen in pregnancy, no bacteria can be found in the blood and that these are probably gonorrhœal or rheumatic in origin. He also makes the statement that previously healthy women may develop endo-carditis during gestation.

Barclay and Bonney<sup>3</sup> say that the acute form is very rare, but mention it under two separate types, typhoid and septic. The septic type being that usually seen in pregnancy.

In 1909 Ryder<sup>4</sup> gave an analysis of nine thousand confinements at the Sloane Maternity Hospital, in which only ninety-two cardiac cases are recorded. Ninety-one of these showed various forms of endo-cardial and myocardial disease, but there was only one case of acute endo-carditis and this proved fatal.

In 1908 Dr. J. C. Cameron<sup>5</sup> presented a series of cases of endo-carditis occurring in the Montreal Maternity Hospital, but all were chronic in character. He, however, makes the statement that a cardiac lesion may begin in pregnancy as a result of infectious diseases, toxæmias or sepsis.

In a paper on endo-carditis in pregnancy by Vinay<sup>6</sup>, he says that acute endo-carditis is very rare during gestation, but is reasonably common in the puerparium in septic cases. He quotes Jacoud as reporting a case under the name of gestational infectious endo-carditis, but, as this patient was a syphilitic, the cardiac lesions were probably secondary.

Crooms<sup>7</sup> reports a case of malignant endo-carditis during pregnancy, together with autopsy. The clinical history of the case would indicate that there was a pre-existing cardiac trouble, with a secondary infection by staphylococci, which were found in sections of the heart valves. This author gives a history of four reported cases, two of which had history of rheumatism, one with a mitral murmur and the fourth was free from any previous history of heart trouble. Two of these cases died from cerebral embolism within a week of onset of acute trouble. At autopsy one case showed a recent valvular infection while the second had recent vegetations implanted upon an old lesion.

Gerhardi<sup>8</sup> says that endo-carditis occurs with special frequency during pregnancy, and the puerparium, but is inclined to look upon

it as a recurrent lesion frequently manifesting itself during pregnancy and the puerparium, frequently with fatal results.

To sum up our observations, we are led to believe that primary endo-carditis in pregnancy is an extremely rare condition. That in cardiac lesions arising in gestation there is almost always a history of some antecedent infection with cardiac involvement which may become active or reinfected during gestation. That many of these cases are rapidly fatal.

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5. J. C. CAMERON.—*Am. Jl. Obs.*, 1908, lviii, 422.
6. VINAY.—
7. CROOM.—*Jl. of Obs. and Gynaecology*, 1908, x, 22.
8. GERHARDI.—“Chap. Puerp. Endocard.”, 1914.

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THE possibility of aerial hospitals for the cure of tuberculosis and other diseases is being discussed by British journals. Advantage is claimed from the facts that the air at high altitudes is absolutely free from germs; and that the atmospheric pressure becomes progressively less as one ascends. The germ-free environment is what the surgeon is constantly seeking at the cost of infinite labour, expense and care, and to the physician it is equally valuable because it withdraws the danger of reinfection from fresh sources. The diminishing pressure of the atmosphere is claimed to be of further assistance in the treatment of tuberculosis; since at ground level the lungs are never thoroughly emptied of air, and the “dead” air left in their cavities is a factor in causing lung disease. Freedom from germs, lowered atmospheric pressure, and the complete sun-bath obtainable may lead to the creation of aerial hospitals, for specially selected early cases of consumption.

## THE TRAINING OF THE SURGEON

BY JASPER HALPENNY, M.A., M.D., F.A.C.S.

*Winnipeg*

THE available knowledge relating to medicine has now reached such great proportions, no one human mind can encompass it all. Of necessity, specialties have sprung up. Of these specialties, surgery was one of the first to appear, and the range covered is one of the largest as well in the breadth of matter as in the number of patients. And it might be interjected here, that after all the whole science of medicine exists for the patient. In other words, the patient stands pre-eminent.

As to surgery, surgeons are made, not born. The making process we call education. Education should commence when the child begins to use its hands. It should be taught to use both hands equally well, as nearly as possible. As it grows, it should have its reasoning power developed, its ability to observe and record its observations, and its mechanical ability should be encouraged.

Pre-medical training is not yet settled. Should the prospective medical student take a degree in arts? One can scarcely agree that the experience of McGill Medical School is the experience elsewhere. Dr. Adami, speaking on behalf of McGill, and addressing the medical students of Toronto University in 1910, said: "At McGill we have noted as a common occurrence that the frequent B.A.'s amongst our students—of course, there are brilliant exceptions—do but poorly in their first two or three years under us. . . as a rule in their final years these men get into their pace again and do excellently. . . . But all the same, I believe they have wasted roughly a year of their student life."

The experience elsewhere is preponderantly in favour of a degree in arts when possible. And if a degree in arts, what is the best course to take? The popular idea is in favour of the natural sciences. One cannot help but think that a course in philosophy would be preferable, providing as it does a grounding in reasoning.

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Read at the Hamilton Medical Week, May, 1918.



The undergraduate course must fill a large place in the training of the surgeon. Furthermore, the training for the coming surgeon, during the undergraduate course, should be identical with that of all other medical students. With all our specialties, we must remember that the patient is a unit. The specialty should be begun only after a broad view of the whole is gained. One cannot agree at all with that renowned English surgeon, Rutherford Morrison, when he said to this Association at St. John, in 1914: "The teaching of those students who are to become practitioners should be different in character and more limited in aim than that intended for developing surgeons." It cannot be decided at the commencement of the undergraduate course, in this country at least, who will and who will not make a surgeon. All should take the same fixed minimum amount of training. Any very brilliant and industrious student might be allowed to do extra work.

If the position just now taken is tenable, the first thing to discuss is the whole undergraduate course and that both in a general way, and also particularly as it applies to the coming surgeon.

There is good precedent for opening up this question of medical training in Canada. Arthur Dean Bevan said to the American Medical Association in 1917: "I believe that the American Medical Association should undertake the task of establishing in some way educational requirements, including a clinical training, sufficiently high to eliminate incompetent surgeons." His words could equally well be applied to the Canadian Medical Association. Possibly the medical schools will show resentment if the surgeons express their opinions on medical education.

Let me quote Alexander McPhedran when he addressed the Alberta Medical Association at Edmonton in 1911: "That the profession through their national authorities have a right to consider the efficiency of the instructors in the institutions sending graduates for license to practice, cannot be gainsaid."

It is probably safe to venture the opinion that there is much need for a careful revision of the undergraduate course in all the medical schools in Canada. With all the additions to the curriculum in recent years there is grave danger of the students being so busy that they have not time to think. And an all important feature in the practice of medicine is *Thinking*. There might with profit be some subtractions as well as additions, and also a readjustment of the proportion of time spent on the various subjects. The time spent on say anatomy and physiology, with their respective kindred subjects, is probably far from right. During two years of the life

of the average medical student, anatomy absorbs about 50 per cent. of his time and 60 per cent. of his energy.

In the senior years there is a tendency to divorce the laboratory work from the wards where lies the object of the whole thing—the patient. This also exists to a certain extent possibly during the junior years. The laboratory is most valuable as an adjunct but it should not be elevated to a place of independence. McPhe-dran's words are very applicable. "Few of us can do much in the way of laboratory research, but the opportunity comes to all for careful observation on ill people and of accurately recording these observations."

In the undergraduate course, then, after anatomy and physiology, with their kindred subjects histology, pathology and physiological chemistry are taught, the major part of the work ahead is that of learning to make a diagnosis. Next in importance comes obstetrics and then feeding of infants. After these come infectious diseases, dermatology, neurology, and genito-urinary disease. Materia medica and therapeutics are incidental to medicine as are sanitary science and hygiene. The primary years should be built up on the basis of the above. The custom of some men of considering that anatomy and physiology should be taught as self-contained subjects is indefensible. These subjects must be taught as part of a whole.

Granted then that this rough outline of the course is somewhere nearly correct and that diagnosis is not unduly magnified, our problem as surgeons at this stage becomes: how much surgery does the general practitioner or each one of the specialists other than the surgeon need? To make it specific, ask: how much surgery does the ophthalmologist need? Outside of the special features of his own line, he needs a working knowledge of the human body as a whole, in health and in sickness, but he does not need to know how to do a gastro-enterostomy.

A careful perusal of the calendars of the eight schools in Canada, which give a course covering the whole work leading to a degree in medicine, reveals some interesting facts.

In McGill, Dalhousie and Queen's the securing of the degree of doctor of medicine carries with it the degree of master of surgery. If master of surgery means anything, it should mean that the holder of the degree has special qualifications for practising surgery. These schools probably do not mean that this is the case with every student they graduate.

Manitoba gives a C.M. degree, but on a special examination

in surgery alone, on which the candidate must take 75 per cent. to pass. This is better. Would it not be still better to change the whole system completely and give the degree of master of surgery to no one but surgeons? But more of this later.

In Western Canada the village gossip thinks the man from the school which compels every student to accept the degree of master of surgery, is a better man than the graduate from some other schools. They think the man with the degree of master of surgery is necessarily a surgeon, and that the other one is not. In the long run, however, they learn to know better.

The teaching of operative surgery, during the undergraduate course, is a mistake. Every man does not need it. Those that will need it in later life should at this time be getting up diagnosis and all that goes with it. The direct preparation for doing surgery should begin after graduation. It is a grave error to think that operative surgery should not only be taught during the undergraduate course, but that it can be taught on the cadaver. The very high regard a surgeon should have for living tissue is of supreme importance. This can not be learned by working on dead tissue.

In the undergraduate course, all that should be taught of orthopaedics should be the diagnosis and an outline of what can be done to improve the abnormal condition. Details of treatment should not be taught at all. In genito-urinary diseases, the diagnosis should be taught, and, in addition, the treatment of acute gonorrhoea, and a knowledge of the treatment of syphilis should be acquired. The student does not need to be instructed in the details of giving neosalvarsan. Neither should he be taught to use the cystoscope, though he should know how to interpret the findings given him by the cystoscopist.

No more should abdominal or extremity surgery be taught at this time. Any student with two eyes and a fair amount of grey matter will be interested enough in and see enough of surgery in any well organized hospital. He will get all that he has time for if he gets up the diseases and their pathology. Many a student knows less about inflammation when he graduates than he does about abdominal operations. He is not to blame. We teachers are.

Not only the subject matter, but methods of teaching are open to question. Regarding the clinical teaching of the final years one agrees with Tinker who says, "there is always the temptation to present the unusual and rare cases, which interest the teacher, to whom the ordinary disease and injury are commonplace." In

the same article he says: "The hours which should be spent in teaching surgical diagnosis, are given over to clinics which are most useful to demonstrate the skill and boldness of their teacher as an operator, than with subjects which would be useful to them in practice."

At this time of specialization the teaching in medical schools drifts more and more into the hands of the highly trained specialists. In time all the teachers will be specialists. Each tends to do the same in his teaching, as is so common in practice, viz.: to magnify his particular department often to the extent of ignoring the unity of the patient. If medicine is to preserve a well balanced proportion, with due regard to the oneness of the patient, the teaching must either be in the hands of specialists who do not forget the above mentioned unity of the patient, or it must drift back into the hands of the general practitioner. The latter is not desirable.

In this it will be observed by some that there is no suggested place for surgery whatever. Well, what is surgery? If it is only doing operations, then there is surely no room for surgery up to this stage. If surgery includes making the diagnosis, then it is included. And who will say that the major part of surgery is the mechanics, and that the minor part is the making of the diagnosis? Surely the diagnosis here, as in internal medicine, is the beginning point.

After finishing the academic term, no student should be given a license, and possibly not a degree, until he or she had served at least one and better two years residence in an approved hospital. All students, irrespective of whatever specialty they may intend to follow, should have this general training in a hospital. (For men who have got thus far at a fairly early age, say twenty-three or twenty-four, two or three years spent in general practice would be of great value to the surgeon-to-be.)

At this stage the man who wishes to be a surgeon should begin to get the special training necessary to equip him, but not before. He should now spend at least two years more, and better, three, as resident surgeon in some well organized teaching hospital, or associate himself with some surgeon of wide experience and good judgement for an equal length of time. Many young men would most gladly spend this amount of time in a hospital if a fair stipend were offered. Safe it is to say that for the second year's residence in hospital, the intern would be content with even the pay of the operating room orderly. The young man who is willing to spend all these years in training for highly specialized service for the



public, is surely entitled to some financial remuneration during the last years of his training, which years, be it remembered, are full of service to the people.

As the potential surgeon grows in judgement, caution and knowledge, he should have increased responsibility placed on him even to the extent of doing much work himself, first under the eye of his chief and later, alone. The man must be given a load to carry all by himself in order to make him realize what responsibility a surgeon assumes when in practice on his own account. Any house-man worth the name will not abuse the confidence reposed in him by his chief.

Halsted says: "The faults of our system of educating surgeons begin almost at the bottom and continue to the top. I am considering only the training of the best men, those who aspire to the higher career in surgery. On graduation they become hospital interns, but their term is only one and a half, occasionally two years, not as long, on the average, as that required of each medical graduate of the University of Tokio. . . . It is a grave mistake, it is a shame, to check suddenly the advance of these superior young men, who are tense with enthusiasm, who rejoice in the work to which they hope to be able to dedicate their lives. It is from these men, we must not forget, we are to draw our teachers of surgery." Three years spent thus will be vastly more valuable to him than a post-graduate college course with a degree at the end of it.

During the term of internship, provision should be made whereby work on anæsthetized animals may be done. It is highly desirable that this work be carefully supervised, else it may develop into careless habits, because of the knowledge that the dog is to be sacrificed soon, possibly at the end of the operation. If properly supervised, this is an adjunct that cannot be too highly regarded.

After training is completed and the man gets out into practice, how is he going to get the necessary cases? Montreal has closed hospitals. Is there any opportunity for the young surgeon to prove that he can "make good". Surely the custom in Montreal is too conservative. There is in that policy very little that offers an open door to the hard working, well trained young surgeon. Winnipeg has the "open door" policy, whereby any man can operate on a private patient when he can find one. This policy gives opportunity to the young surgeon. It is at the same time open to grave abuse. Stewart rightly observes: "Recent medical graduates rush in and do major surgery, their first attempt at abdominal operation being saved from fatal results by the grace of God and

access to a clean operating room." The open door must be carefully guarded by a board of management guided by a superintendent with a conscience, so that surgeons, but none other, are allowed to operate.

When once a surgeon has got the necessary training and the necessary cases, his future as a true surgeon depends on how he reads, how he thinks, and how he records. Reading is the easiest task. Journals and books are only too numerous. The busy surgeon sometimes forgets to think and ponder. Visits to other clinics are most essential. A good system of recording and following up cases is equally essential. With regard to the latter feature it is probably the weakest point in the life of the average surgeon.

In conclusion it is respectfully suggested:

1. That there should be an agreement among all the medical schools in Canada on the general principles regarding the teachings of surgery.

2. That the C.M. degree, as it is now stands, should be abolished.

3. That a new degree be established, with the same or a similar name, to be based largely on work actually done, rather than on a formal examination only.

4. That for the present this degree be granted not sooner than four years after graduation, and that, by mutual agreement amongst the universities of Canada, this time be extended later on to five years.

5. That all hospitals to which any public money is contributed either for construction or maintenance should open the private wards to any man holding the above mentioned degree and who is known to the board of management to be a man of unquestioned reliability.

And finally:

6. That this surgical section of the Canadian Medical Association take the initiative in the matter of setting requirements for surgeons. This could possibly be best done by working in conjunction with the American College of Surgeons, to which a goodly number of the Canadians belong.

## BOTULISM

BY ERNEST C. DICKSON, M.D., *Captain, C.A.M.C.*

**M**Y object in appearing before you is to draw your attention to a type of food-poisoning caused by the ingestion of home-canned products which has assumed considerable importance on the Pacific Coast of the United States during the past few years, and which is occurring with increasing frequency in other portions of that country. I am unaware of any established cases in Canada, although there is little doubt that some will appear, but recent reports have shown that botulism has occurred with some frequency in England, and it therefore behooves us to become acquainted with the condition and to recognize the causes for its occurrence and the means by which it can be prevented.

Botulism or Allantiasis, the old *Wurstvergiftung* of Southern Germany, has been recognized as a serious type of food-poisoning since the early part of the nineteenth century, but it has been thought to be exclusively a type of meat poisoning, since the greater number of cases, as the name implies, was caused by the ingestion of sausages. So firmly has the idea that it is exclusively a meat poisoning been established, that when, in 1904, an outbreak of poisoning from bean salad occurred in Darmstadt in Germany, Landmann, who investigated the outbreak and who proved that it was indeed botulism, made the statement that there must have been some pork cooked with the beans since it is impossible for the toxin of *B. botulinus* to be formed in other than meat-containing medium.

Our accurate knowledge of the fact that botulism may be caused by the ingestion of foods of vegetable origin dates from December, 1913, when there was an outbreak of food-poisoning of the botulinus type at a Sorority house at Stanford University, in which twelve persons were poisoned by eating a salad prepared from home-canned string beans. We were unable to prove from this outbreak that the intoxication was indeed botulism as we were

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From the laboratory of experimental medicine, Stanford University Medical School, San Francisco, California.

unable to demonstrate *B. botulinus* from any of the materials which were available for bacteriologic examination, but, stimulated by this outbreak, we obtained cultures of *B. botulinus* from the Museum of Natural History, and from the Department of Bacteriology of Columbia University in New York, and commenced a series of experiments which have been continued until a few weeks ago. As a result of our experiments we have established beyond all doubt that the toxin *B. botulinus* may be formed in mediums prepared from peas, beans, corn, asparagus, artichokes, peaches, pears, apricots and prunes, and since the outbreak which occurred at Stanford University, we have been able to collect records of a fairly large series of outbreaks in which it was established that the poisoning was caused by the ingestion of one or other of these vegetables or fruits. All of them home-canned.

The symptomatology of botulism differs from that of the usual types of food-poisoning in that the intoxication is essentially one which involves the central nervous system. The condition is not an infection, but is a true intoxication, the poisoning being produced by a bacterial toxin, somewhat analagous to the toxins of diphtheria and tetanus, which is formed in the food before it is eaten and which is ingested with the infected food. The toxin is never formed within the body, as the optimum temperature of *B. botulinus* is from 24 to 28 degrees Cent. and the toxin will not form at a temperature of 37.5 degrees Cent., the normal temperature of the body. It differs from the toxins of diphtheria and tetanus in that it is not digested in the gastro-intestinal tract, but is absorbed unchanged into the blood stream.

The symptoms usually appear in from eighteen to thirty hours after the ingestion of the poisonous food, although they may appear in from four to eight hours. The earliest symptom is usually a sensation of languor and fatigue, but this is soon followed by characteristic disturbances of vision, blurring of vision, diplopia, and loss of accommodation. There is often early vertigo and incoordination of muscular movement. Dryness of the mouth and pharynx, a sensation of enlargement of the tongue and a peculiar sensation of constriction of the throat soon follow. There is marked inhibition on the serous salivary secretion, and the mucus portion is secreted in a thick, tenacious form which is removed from the pharynx with great difficulty. Speech soon becomes impaired and unintelligible, and there is difficulty and eventually inability to swallow. The patients suffer greatly from strangling spells induced by their attempts to swallow or to raise the thick mucus from



the pharynx. There is rarely any acute gastro-intestinal disturbance, although there may be initial nausea, vomiting, and diarrhoea. A characteristic feature of the intoxication is that there is obstinate constipation which may be so severe as to resist all efforts to induce evacuation of the bowels.

There is early blepharoptosis and mydriasis with loss of pupillary reaction to light, and occasionally there is paralysis of all the extrinsic muscles of the eye so that the eye-ball remains fixed in the socket. Occasionally there is paralysis of the muscles supplied by the motor portion of the fifth and by the seventh cranial nerves, but this is more uncommon. There is loss of the pharyngeal reflex in the majority of cases. There is marked general muscular weakness, but there is no true paralysis of the skeletal muscles and the skeletal reflexes are not lost. True paralysis is apparently confined to the muscles which are supplied by the cranial motor nerves.

A striking feature of the botulinus intoxication is that there is no disturbance of mentality and that sensation remains intact. There may be some inhibition of the sense of taste, but this is probably chiefly if not entirely due to the absence of the serous salivary secretion. There is rarely any disturbance of hearing. The disturbances of vision are entirely dependent upon the loss of function of the intrinsic muscles of the eyes, as the retina rarely shows any change. There may be initial headache and nausea, but there is otherwise rarely any pain.

The temperature is usually sub-normal; in fact, when fever occurs, one should be strongly suspicious of the onset of some intercurrent infection such as broncho-pneumonia. The pulse rate may be slower than normal at first, but it soon becomes rapid and the combination of a temperature of between 96 and 97 degrees Fahr. with a pulse rate of over 130 is very striking.

The intoxication usually reaches its maximum severity in from four to eight days, and then, if the patient survives, gradually subsides. Convalescence is very slow and tedious. In fatal cases, death usually occurs in from four to eight days, and it is seldom that persons who survive for ten days succumb unless some complication such as aspiration pneumonia ensues. Death usually occurs from cardiac or respiratory failure.

The mortality in the European cases, occurring during a period of over one hundred years, is about 40 per cent., but in the United States, probably because only the severe cases are recorded, the mortality has been between 65 and 70 per cent. When patients recover there is rarely any persisting disability.

Treatment is most unsatisfactory. It is important to wash out the stomach even though the poisonous food has been eaten several days before, as there is early inhibition of stomach motility, and cases are recorded where portions of the poisonous meal have been found in the stomach at autopsy several days after it was ingested. Purgation should be induced if possible, preferably with magnesium sulphate or some similar saline and the lower bowel should be frequently washed by enemata. Simple, nourishing food should be given in sufficient quantities and a generous supply of water should be administered, but it should be remembered that on account of the loss of pharyngeal reflex and the frequent strangling spells when the patient attempts to swallow, there is constant danger of insufflation pneumonia. It is therefore advisable to administer food and laxatives by stomach tube and to give water by hypodermoclysis or by rectum. The Murphy drip has been found to be very satisfactory.

Stimulation should be given as required; strychnine probably being of value. Digitalin has been used extensively to combat cardiac failure, and pilocarpin may be used to relieve the dryness of the mouth and pharynx, although pilocarpin should be given with caution, since the patient is unable to cough up fluid from the lungs if pulmonary edema is induced.

Antitoxic serum may be produced but experiment has shown that it is of little therapeutic value unless it can be given very early. It affords full protection to guinea pigs when mixed *in vitro* and injected with the toxin, but when given more than twelve hours after the administration of a M.L.D. of toxin, there is little protection. I have used antitoxic serum in two human cases of botulism and both recovered, but I am not at all certain that the serum in any way influenced the course of the intoxication, as it was several days after the ingestion of the poisonous food that the serum was given.

The pathology of botulism is extremely interesting in that there is a peculiar, characteristic type of thrombus formation in the blood vessels of practically all organs, the thrombus being studded with leukocytes. The symptoms are not explained by the presence of the thrombi, however, as the thrombi are rarely found in animals which have died within forty-eight hours after the administration of the toxin. There is also marked hyperæmia of practically all organs and usually there are many hæmorrhages in the meninges and in the lungs and serous surfaces. Our experiments and our histologic examination of tissues from human victims

do not support the theory that there is a so-called specific action on the finer structure of the nerve ganglion cells.

The importance of this type of food-poisoning at the present time lies in the fact that by far the greater number of cases which have occurred in the United States have been caused by the ingestion of home-canned vegetables and fruits. The reason for the prevalence of the botulinus toxin in home-canned vegetables and fruits is that many of the methods of sterilization which are employed in home-canning are not sufficiently potent to kill spores of *B. botulinus* when mixed with albuminous material in containers such as are used. The common practise is to immerse the filled jar of vegetable or fruit into boiling water in a wash-boiler for from two to three hours and this is not sufficient. We have found in test tube experiments with emulsions of spores of *B. botulinus* in brain and in vegetable mediums that the spores will resist immersion into actively boiling water for more than two hours, and will resist immersion into water at 95 degrees Cent. for more than three hours. Eight strains of *B. botulinus* were tested in this way, and the results were constant in seven. When one considers the time necessary for the penetration of heat into the centre of a closely packed jar of vegetable, it is readily understood that the sterilization in the centres of the jars may be incomplete.

The addition of lemon juice or vinegar to vegetables as recommended by Cruess of the University of California, greatly reduces the resistance of the spores to heat, but lemon juice must be added in amounts of at least 4 per cent. to be of value. I have record of one outbreak of botulism which was caused by the ingestion of string beans to which "a small amount" of lemon juice had been added, but evidently the amount of lemon juice was insufficient. Our experiments have shown that the mere presence of 4 per cent. lemon juice or of 65 per cent. cane sugar in bouillon is not sufficient to prevent the growth of *B. botulinus*, and the formation of its toxin, although they do inhibit the toxin formation to a certain extent. It is therefore apparent that one must not depend upon lemon juice or sugar to preserve the fruits or vegetables unless the sterilization has been complete.

A very few outbreaks of botulism caused by commercially canned vegetables have been recorded, but they are very rare. The rarity depends, I believe, upon the fact that in the United States the vegetables are sterilized with steam under pressure at a temperature of from 240 to 250 degrees Cent. The freedom from contamination of commercially canned fruits which are canned at

lower temperatures is probably dependent upon the fact that only carefully selected, hand-picked fruit is canned. In the only instance of poisoning from home-canned fruit in which we were able to get all the data, it was found that the fruit had been unsalable, wind-fall fruit, and it is probable that the fruit had become contaminated with *B. botulinus* while lying on the ground.

It must not be understood that I am advocating any decrease in the amount of home-canning of perishable foods, but I am convinced that as professional men who are interested in the preservation of the health of the community, we should take steps to have the public understand that the use of home-canned food is not unattended with danger, and that, with proper care, all danger of poisoning may be averted. Very often the home-canned food which is contaminated with toxin of *B. botulinus* is so evidently spoiled that it is discarded at once and no accident occurs unless it is fed to domestic animals or fowl. There are, however, many instances when spoiled home-canned food has been fed to domestic animals and fowl, and they have developed symptoms which are analogous to those produced by botulinus intoxication in human beings, limber-neck in chickens and turkeys, forage poisoning in horses and mules and "paralysis" in hogs. At other times the food is not so evidently spoiled and poisoning may be caused by the housewife tasting it to determine whether it is good. I have records of six outbreaks of botulism which were caused in this way, and five of the six victims died. Usually there is a peculiar cheese-like odour in food which is contaminated with toxin of *B. botulinus*, and it is this odour which attracts the housewife's attention and causes her to taste the food. Often, however, this odour is so faint that it does not attract attention, unless one is familiar with it and is looking for it.

All of the cases of poisoning by home-canned products have occurred when the food has not been cooked before it was eaten. Is it a common thing to serve home-canned vegetables without cooking as salad, and in such cases there is especial danger, as the toxin has a peculiar sharp taste which is quite palatable in salad. At other times the poisoning has occurred after the ingestion of fruits which are "a little turned" and which are not displeasing to the taste. It has been definitely established that the toxin is destroyed if it is heated to the boiling point and that contaminated food is entirely safe in so far as botulinus intoxication is concerned if it is cooked before it is eaten. There are numbers of instances in which portions of contaminated food have been cooked and eaten



without ill effect whereas the remaining portion has been eaten as salad and has caused fatal poisoning.

The important facts that should be emphasized in connection with botulinus intoxication from home-canned foods are the following:

1. That only the best available methods of home-canning should be recommended.
2. That the housewife should not be discouraged from canning perishable foods but that she should be instructed as to the possible danger of poisoning in using home-canned food and as to the methods of preventing its occurrence.
3. That under no circumstances should home-canned food which shows any sign of spoilage be used as food or even tasted.
4. That the slightest indication of an unusual odour should be regarded as sufficient reason for discarding home-canned food.
5. That all home-canned food should be boiled before it is eaten or even tasted.

If these precautions are taken, there will be no danger of the occurrence of food-poisoning of this type from home-canned products.

FOOT-NOTE.—For a more complete discussion of symptomatology and pathology, see "Botulism, a Clinical and Experimental Study." By E. C. DICKSON. Monograph No. 8 of The Rockefeller Institute for Medical Research.

## THE AFTER-EFFECTS OF WOUNDS OF THE CHEST AND THEIR TREATMENT

BY JOHN MEAKINS, *Lieutenant-Colonel, C.A.M.C.*

AND

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THE eventual degree of disability of soldiers suffering from wounds is of great importance, not only from the military, but equally from the civilian point of view. In all classes of injury the object to be striven for is such reduction of the disability as will make the patient again fit to be a soldier. Where this is not feasible, it is the aim of the physician to reduce the disability as much as possible in order that the patient may resume his civil life with no greater handicap than can be avoided. The seriousness of certain classes of injury is directly proportioned to the extent it reduces the capacity to do physical work, independently of the amount of damage that may have been done. In this category are included those cases which have received penetrating wounds of the chest. The severity of the original injury need not be, in fact is not, in these cases an index as to the eventual usefulness of the individual. Some cases are disabled out of all proportion to the apparent seriousness of the wound, while others with greater local disturbance make remarkable progress and eventually exhibit little or no diminution in power of physical exertion. The present work was undertaken with the twofold object of investigating the after-effects of injury to the chest and of determining the best means of reducing the disability to a minimum.

The observations to be reported are based on seventy such cases admitted to this hospital during the latter six months of 1917. The majority were received direct from France, where they had been under treatment for an average period of four weeks (from three days to fourteen weeks). The cases varied considerably in character. Eleven (15·7 per cent.) had been operated upon for the evacuation of pus in the pleura, while in nine cases (12·8 per cent.) the foreign body had been removed. With regard to these latter,

it should be noted that in all except one case the foreign body was merely removed from under the skin. In the exceptional case it had been removed from the left lung close to the pericardium at the time of operation for empyema. In 60 per cent. of the cases there was a history of hæmoptysis, it being of a severe character in one case only. In 66 per cent. there was a history of fluid in the pleural cavity.

On admission to this hospital, careful notes were taken as to the condition of the chest. In 28.6 per cent. of the cases no abnormal physical signs could be detected, although in all of these there was clear evidence of penetration. In the remainder the examination revealed conditions as set forth in Table I.

TABLE I.

Collapsed lung.....	2.9 per cent.
Thickened pleura.....	38.6 "
Fluid.....	12.8 "
Fluid and thickened pleura.....	12.8 "
Air.....	4.3 "

In all those cases which had been operated upon in France for empyema, a discharging sinus still existed, and in only one of these was a secondary operation necessary. In this case the injury had involved the abdomen, and a subphrenic abscess had developed in the left side, which was drained through a small hole in the pleura. Eventually this opening had to be enlarged to permit of better drainage. Empyema developed after admission to this hospital in three cases, in all of whom fluid in the chest had been reported from France. In one case only was it found necessary to remove the foreign body from the lung. In all of the cases, except two, the physical signs were quite typical of the condition which was supposed to be present. In both of the cases which presented atypical signs there was increased vocal resonance and tactile fremitus over the abnormal area. All the other physical signs were those which are considered the classical signs of pneumothorax. It was difficult to account for these abnormal findings. In both of these cases there was only a partial collapse of the lung. In the series there was one other case of pneumothorax. There was complete collapse of the lung in that case. At first there was absence of tactile fremitus and vocal resonance. Later there developed slight expansion of the lung and a distinct increase of both of these signs over the normal side.

The progress of the physical signs was carefully noted in relation to the improvement or otherwise of the patient's condition,

and in regard to his ability to accomplish physical work. But it soon became apparent that little or no information of value as to this point could be obtained by percussion or auscultation. The most significant finding was the development in a varying degree of a distinct physical deformity, which progressed without any change in the physical signs except those revealed by inspection. This deformity was manifested in various ways. It varied from a simple muscular atrophy with or without pronounced drooping of the shoulder girdle, to conspicuous contraction of the chest wall, with curvature of the spine.

In order to obtain reliable and comparative records of the progress of this deformity, it was necessary to adopt more accurate methods than those of ordinary inspection. It was found impossible by observation alone to detect any change of less than one-half inch in the relative levels of the shoulders, and this was particularly difficult in estimating the improvement or otherwise in the condition. Therefore a height gauge was devised. This consisted of an upright or standard with two sliding arms. The patient was placed in front of this and the standard was aligned with the axis of the spine. The arms were then adjusted in such a manner that the wedge-shaped pointers rested exactly on the acromio-clavicular articulation of each side. On the back of the standard a scale in inches indicated directly the difference in level between the two shoulders.

It was also difficult to determine the shape and relative size of the two sides of the chest, and any changes which might subsequently occur. Therefore a cyrtometer was employed, and the outline of the chest transferred to a large piece of paper. These outlines were then reduced to half size by means of a pantograph, and filed with the case sheets.

The deformity frequently appeared very early. The earliest was recorded two weeks after the date of injury. The first manifestation is a muscular atrophy about the points of injury. This may progress in a varying degree, so as to involve all the muscles of the chest wall and the shoulder girdle. It may even extend to the deltoid and muscles of the upper arm of the injured side. As a consequence of this atrophy, an early droop of the shoulder becomes apparent. The further deformity follows upon a falling-together of the ribs, which may be finally accompanied by curvature of the spine. At any stage the progress of the deformity may cease.

The determination of the cause of this deformity was recognized as of first importance. In view of the fact that the missile



traversed, in all cases, the chest wall, the pleura, and the lung, it seemed probable that the deformity was the result of the injury to one of these.

In so far as could be determined, direct injury to the muscle produced in itself only slight atrophy, which was confined to the single muscle injured. In cases where the ribs were fractured, without signs of the involvement of either the pleura or the lung, any deformity which occurred was strictly dependent upon the local condition. If there had been loss of portions of the ribs, or if the fracture was not in proper alignment, a local deformity of greater or less extent naturally occurred; but if there was no loss of rib substance and the fracture was in good position, no deformity ensued. Furthermore, an analysis of the site of the wound showed that it was immaterial whether the injury was above or below the third rib, as there was practically an equal prevalence of deformity in either case. In no case did any general deformity result unattended by signs of disturbance of lung or pleura.

With regard to injury of the lung tissue, it was found that the presence or absence of a history of hæmoptysis gave no indication as to the future presence and degree of deformity. Likewise in those cases in which the foreign body was retained in the lung substance, this did not appear to have any influence on its development. In so far as local collapse of the lung was concerned, in no case did this occur without a history of the co-existence of either fluid or air in the pleura. In fact, there was no evidence that injury to the lung tissue *per se* had any influence on the development of the deformity.

On examining into the degree of disturbance of the pleural cavity, it was found that in 94 per cent. of the sixteen cases where the pleura was free from all evidence of disease, little or no deformity occurred. In one case the patient suffered from an infected bomb-wound just below the middle third of the right clavicle, which had necessitated an extensive incision through the pectoral muscles. This had healed by secondary intention, and the ensuing contraction of the scar had produced considerable deformity of the right shoulder. The general deformity in this case is accounted for by a strictly localized condition.

TABLE II

Deformity	Pleura free Per cent.	Hæmothorax Per cent.	Pyothorax Per cent.	Pneumothorax Per cent.
Nil.....	57	39·5	7	0
Slight.....	37	39·5	40	50
Moderate.....	6	6	26·5	16·6
Conspicuous.....	0	15	26·5	33·3

It will be seen in Table II that there was a progressive diminution in the number of cases exhibiting no deformity, and increase in those which did, depending upon the manner in which the pleural cavity was involved.

The cases of hæmothorax presented two well defined classes, determined by the absence or presence of fluid in the pleura when they came under our observation. The former class comprised twenty-five patients. All of these gave a history of hæmothorax, but in none of them were there signs of fluid after an average period of three weeks from the date of injury. Among these no instance of marked deformity developed. It was at first thought probably that these cases might have suffered from only a small hæmothorax, and this might have accounted for the fact that no deformity developed. But in fourteen of the cases aspiration had been performed one or more times, although only in six of these was the amount recorded. It averaged about 800 c.c. (240 c.c. to 1,800 c.c.). One of these cases was wounded on August 12th, 1917, in the left intercostal space in the axillary line. On the 15th 500 c.c. of blood were aspirated. Another 500 c.c. were removed on the 18th, and on the 21st 800 c.c. more of bloody fluid were aspirated. On admission to this hospital on the 29th, the physical signs were practically normal. No deformity developed in this case, except slight atrophy of the thoracic muscles of the back. Therefore this could hardly account for the absence of deformity. The latter class comprises eight cases, in each of which fluid was present when the patient was admitted to this hospital. In one of these the injury had occurred a week before. Shortly after admission 500 c.c. of bloody fluid were aspirated and the signs of fluid soon disappeared. This case did not develop any deformity.

In the other seven cases there were signs of a varying amount of fluid in the pleura, after several months had elapsed, since the time of injury. In three of them aspiration had been done some time before. In all seven cases pronounced deformity existed when admitted, and this showed a tendency to increase. It seems, therefore, that the persistent presence of fluid in the pleural cavity plays a conspicuous part in the eventual development of deformity of the chest.

Empyema developed in fifteen of the cases. Of these, seven (47 per cent.) were operated upon within fifteen days of the time of injury, and in none of them did any general deformity follow. In eight cases (53 per cent.) however, the operation was not performed until an average period of six weeks had elapsed. In all of these cases a conspicuous deformity did develop.

There appears, therefore, to be a close connection between the development of the deformity of the chest and the length of time that the pleura is allowed to retain a quantity of fluid, irrespective of whether it be sterile or infected.

Only six of the cases gave a history of pneumothorax. Two of these evidently had a hæmopneumothorax while in France. They were both repeatedly aspirated, and when admitted to this hospital, seventeen and twenty days later, there were no signs of either air or fluid in the pleura, and only slight evidence of thickened pleura. Another case was reported to have had an extensive pneumothorax in France, which necessitated aspiration for relief of the symptoms. When admitted to this hospital, five weeks later, there was a small localized pneumothorax about the site of the wound of entrance. This was situated anteriorly over the inner end of the second rib. There was loss of substance of this rib, and a hernia of the lung about three inches in diameter, which eventually disappeared by the use of a firm pad. In none of these three cases did any deformity of an appreciable degree develop.

One of the other three cases gave no history of a pneumothorax, but on admission to this hospital there were signs of a moderate hæmothorax with an extensive pneumothorax which caused urgent symptoms. Aspiration was performed which gave relief. This was done two and a half weeks after time of injury. The recovery of this case was very tedious but progressive. A moderate deformity developed, which under suitable treatment had practically disappeared at the time of discharge.

The two remaining cases, on entrance to this hospital, were quite normal except for the small entrance wounds, which were healed. One of these cases developed acute dyspnoea with collapse on the first occasion of being out of bed, five weeks after the injury. On examination there were signs of pneumothorax. The symptoms were paroxysmal, occurring in the evening and lasting a few hours. There was no increase at these times in the signs, which showed involvement of the whole right thorax, with complete collapse of the right lung. On the third day aspiration was performed, which relieved the urgent symptoms of dyspnoea and orthopnoea, but made no impression on the physical signs. Repeated aspiration did not effect any reduction of the pneumothorax. The recovery in this case was extremely slow, and the consequent deformity most conspicuous.

The other case gave a history of a right pneumothorax with complete collapse of the lung. There were no signs of pleural

involvement on admission to this hospital. He developed an acute recurrence of the pneumothorax six weeks after the injury on being out of bed for the first time. The symptoms were not as severe, nor did the signs, which were confined to the upper half of the chest, indicate such an extensive degree of collapse of the lung as the former case. The most outstanding feature was the asthneia and neurotic symptoms, both of which retarded recovery. On being allowed out of bed again, there was evidence of considerable deformity of the right chest. On suitable treatment, however, there was great improvement, until on discharge it was almost impossible to detect by examination which side of the chest was injured.

In view of the above facts it appears permissible to account for the varying degrees of deformity which may develop in cases suffering from penetrating gunshot wounds of the chest as follows: Those cases in whom there is a simple perforation of the chest, without appreciable and persistent involvement of the pleural cavity, as a rule show some local atrophy of the muscles. The muscles are temporarily splinted, particularly if there is pain caused by respiration, and if a cough is present this splinting is accentuated. Furthermore, if the pectoral muscles or the latissimus dorsi be perforated, and movement of the arm is also considerably restricted, the local atrophy becomes more conspicuous. Thus there may be moderate drooping of the shoulder of the affected side, which frequently develops very early, the result of atrophy of the muscles of the shoulder girdle, apparently due to disuse. But the general conformation of the chest wall is not as a rule altered. A pronounced change in the shape of the chest wall appears only to develop when the pleural cavity is allowed to remain for a considerable period in an abnormal state. In addition to the immobility of the affected side of the chest, which is usually extreme in such cases, there is another factor to be taken into account—namely, the change of the intra-thoracic conditions. When a part of the pleural cavity is occupied by blood (of varying concentration) for some time, organization eventually occurs. This organized material is adherent to both layers of the pleura, and as contraction proceeds, compression of the lung and diminution of the volume of the intra-thoracic contents occurs. This is indicated first by elevation of the dome of the diaphragm. When this has reached a certain point, other factors prohibit its further extension, and in consequence the bony structures of the chest wall become involved. The ribs begin to assume a more oblique position and



come closer together, until evidently the intercostal spaces are greatly diminished in width. Consequent with this collapse of the chest wall the drooping of the shoulder becomes much more pronounced, and if the contraction continues beyond a certain point, scoliosis of the dorsal spine develops with the concavity towards the side of the injury. In some cases of extensive and persistent pneumothorax, a similar sequence of events occurs, even without such involvement of the pleura. In these cases the extensive collapse of the lung over a prolonged period allows carnification to occur, so that when the air in the pleura is eventually absorbed, the lung is incapable of expansion, and therefore the surrounding structures must contract to obliterate the potentially vacant space.

It was found that apparent deformity occurred more frequently and to a greater degree when the right side of the chest was injured. This was evidently due to the rôle played by the diaphragm. In right-sided lesions the elevation of the dome of the diaphragm was strictly limited by the liver, which acted seemingly like a cork. Beyond a certain point it could not go, while on the left side, although naturally limited, the degree of intra-thoracic space which it could occupy was much greater than on the right side.

The treatment of this deformity was based on the principle that prevention would be more fruitful of results than correction after it had developed. Two points were of prime importance: first, the prevention and correction of the muscular atrophy; and second, to increase the power of expansion of the affected lung. It seemed reasonable to suppose that the muscles could be developed by avoiding or overcoming the disuse. This turned out to be the case. It was more difficult to promote the expansion of the affected lung. At first the usual blow-bottles were employed. These, however, developed the side of the unaffected lung more than the affected one. When the blow-bottles are used, the intra-pulmonary pressure is uniformly increased. Therefore the increased expansion would occur where the resistance was least—namely, in the healthy lung. As a result the healthy side became larger, while the affected side became relatively smaller, and the deformity more apparent.

It therefore suggested itself that it was important to splint the healthy side and to force the affected one to do more work. In order to accomplish this, a series of exercises was adopted as follows:

1. The sound side of the chest is splinted against the back of a chair with the arm of this side extended as far as possible and grasp-

ing a rung. Then the patient is instructed to take deep slow inspirations, meanwhile pressing the healthy side against the back of the chair, in order to prevent expansion of the sound lung. In consequence the injured side tends to expand more fully (five minutes). (Fig. 1.)

2. Dumb-bell exercises with a 4-lb. dumb-bell in the hand on the affected side, and a 2-lb. one in the hand of the unaffected side.

(a) Arms raising sideways and bending under the armpit and over to shoulder (five minutes).

(b) Lying on the back; arms raising from side to the vertical and lowering to the horizontal above the head (three minutes).

3. Ladder exercises. The arm of the affected side is fully extended above the head and the highest possible rung of the ladder grasped firmly. The patient is then instructed to take deep, slow inspirations, meantime pulling on the rung of the ladder with the arm of the affected side (three minutes). (Fig. 2.)

It soon became apparent that the sooner the exercises were started the better. Therefore, as soon as a patient had been out of bed for a few days and was capable of walking about without conspicuous distress, the first exercise was started, and as he gained strength, the others were added. It was found that usually at the end of the tenth day of exercise, a patient would be on the full schedule.

An essential part of the exercises was firm encouragement. The object of them was fully explained to the patient. On first commencing the course he was allowed to drop out and rest if he became at all exhausted. Such symptoms as pain and slight breathlessness were explained as being of no serious moment, and the former almost essential for recovery. It is very important that the physical instructor be intelligent and interested in the cases individually, and be under the direct supervision of a medical officer. Also he should realize that the patients are in a curative stage, which may be marred by too strenuous progress. When the patients became strong enough they were given general physical training in combination with the special exercises in order to reduce their "hospitalization" as much as possible.

The result of the use of these exercises was very satisfactory. In those cases which had atrophy of the muscles only, re-development was rapid and complete, while in those with more gross deformity, the improvement, although conspicuous, was not necessarily complete. There were a few cases in whom the deformity had progressed to an advanced degree before the exercises could

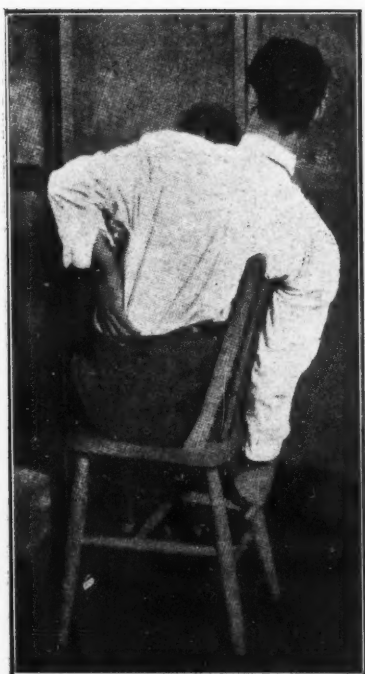


FIG. 1



FIG. 2





TABLE III.

Name	Date	Special notes	Muscular atrophy on side of injury	Difference in sides of chest	Shoulder drop	Spinal deformity
Pte. A. J., 41157. Hæmothorax (L.).....	26-8-17	Wounded	Latissimus dorsi and intercostals	Slight	Slight	None
	12-9-17	..	Increasing	1 in.	Increasing $\frac{1}{2}$ in.	..
	28-9-17	..	..	2 in.	$\frac{1}{2}$ in.	Moderate
	22-11-17	Special P.T.	..	..	$\frac{1}{2}$ in.	..
	6-12-17	..	Slight	2 in.	$\frac{1}{2}$ in.	Slight
	10-12-17	..	Very slight, about	Nil	$\frac{1}{2}$ in.	"
Gnr. J. T., 21509. Pyothorax (L.).....	20-2-18	..		..		
	2-3-18	..				
	1-8-17	Wounded	Pectoralis major and latissimus dorsi	2 in.	$1\frac{1}{2}$ in.	None
	9-9-17	Special P.T.	Less	$1\frac{1}{2}$ in.	$\frac{3}{4}$ in.	"
Pte. R. E., 233631. Pneumothorax (R.)...	10-10-17	..	Slight	$\frac{3}{4}$ in.	$\frac{3}{4}$ in.	"
	20-11-17	..	Very slight	$\frac{1}{2}$ in.	$\frac{1}{2}$ in.	"
	13-12-17	..		..	..	..
	15-6-17	Wounded	Pectoralis major and latissimus dorsi, and intercostals	..	..	..
	26-7-17	..	Progressive	..	Slight	..
	28-8-17	..	Unchanged	$1\frac{1}{2}$ in.	Slight	..
	2-10-17	..	"	..	..	..
	28-11-17	Up for first time	..	..	..	..
	7-1-18	Special P.T.	Much less	..	$1\frac{1}{2}$ in.	Slight
	14-2-18	..	Very slight	Nil	$\frac{3}{4}$ in.	Very slight
	2-3-18	..			$\frac{1}{2}$ in.	Unappreciable
	23-3-18	..			$\frac{1}{2}$ in.	

be begun. In these further deformity was arrested, and a slight improvement occurred; but the bony changes were so pronounced that it was not considered possible to change them more than to a limited degree.

The early commencement of exercise in cases of empyema was of particular value. The patient was encouraged to get out of bed as soon as possible after the operation, and when the thorax was still draining, he started his exercise. At first the discharge would increase, but after a short time this would gradually become less, the drainage tube would be pushed out until eventually the sinus would close. During this time the expansion improved, the deformity and shoulder droop were reduced, and finally the two sides of the chest would be equal in size and movement.

A few typical cases are set forth in Table III in order to show the progress that usually occurs. It will be seen from these cases that there is a progressive diminution in the atrophy of the muscles and the degree of shoulder droop until the two sides are practically equal. This improvement is further demonstrated by the comparative outlines of the chest walls of those cases which are shown in Charts 1 to 3.

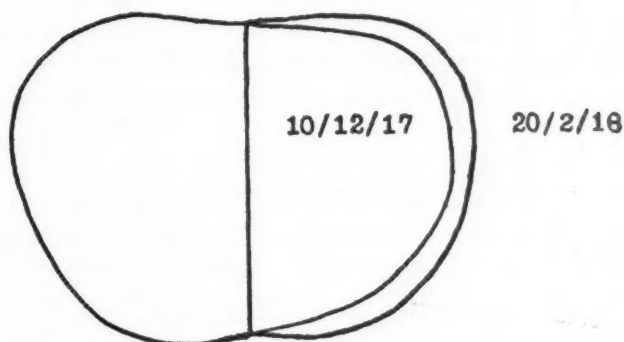
The effect of the retention of the foreign body in the lung was carefully followed. In forty-four cases (63 per cent.) there was clear evidence of retention of the missile. These are analysed in the following table:

TABLE IV

Position of foreign body	Number of cases	Removed	Remaining
In lung.....	35	1	34
In subcutaneous tissues.....	9	5	4

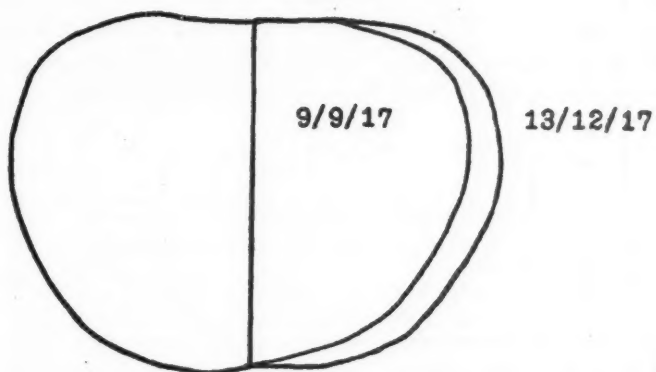
In the five cases where the foreign body was removed from the subcutaneous tissues, it was on account of pain. In only one of the thirty-five cases where the missile was in the lung tissue did any untoward symptoms arise. In this case an abscess developed about the foreign body, from which a sinus led to the wound of entrance. This abscess was situated in the upper part of the right lower lobe, and the sinus was directed downward and backward. The cavity did not completely drain, as periodically the discharge would cease, and there would be coincident rises of temperature. It was therefore considered necessary to remove it. It was localized by *x*-rays, and under nitrous oxide anæsthesia, long forceps were easily introduced into the cavity through the sinus, and the foreign

CHART 1



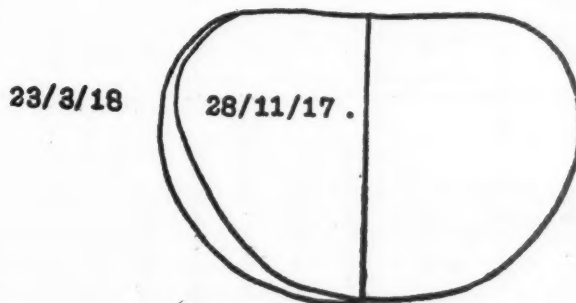
Pts. A. J., 41157. Left hæmothorax. Outline of chest wall before and after a course of special physical exercises.

CHART 2



Gunner J. T., 21509. Left pyothorax with operation. Outline of chest wall before and after a course of special physical exercises.

CHART 3



Private R. E., 233681. Right pneumothorax. Outline of chest wall before and after a course of special physical exercises.

TABLE V

Disposal	Number	Number traced three months after discharged	PRESENT STATUS OF THOSE TRACED						
			B.E.F.	A. 3	B.	D. 1	In hospital	P. U.	Totals
Furlough I.....	1	1	..	1	..	..	..	..	1
Furlough II (D <sup>1</sup> ).....	47	29	9	7	74	4	11	12	29
B.....	4	2	..	..	2	..	..	..	2
Convalescent hospital.....	1	1	..	1	..	..	..	..	1
Auxiliary hospital.....	2	1	..	..	..	1	..	..	1
Trans. to other hospitals.	2	0	..	..	..	..	..	..	0
Remaining in hospital.....	7	0	..	..	..	..	..	..	0
Permanently unfit.....	6	5 <sup>3</sup>	..	..	..	..	2 <sup>3</sup>	3	5
Totals.....	70	39	9	9	9	5	3	4	39

<sup>1</sup> In hospital for removal of F. B. from subcutaneous tissue of back.

<sup>2</sup> Sent to Australia for "change."

<sup>3</sup> Two cases were invalidated to Canada for further treatment other than for the intra-thoracic condition.

<sup>4</sup> One case is likely to be raised in category.



body, which was oblong in shape, was seized at one end and readily removed until it reached the skin, where a slight enlargement of the opening was necessary. After this, the patient made an uninterrupted recovery. In all of the other cases the presence of the foreign body in the lung exerted no untoward influence on the progress of the case.

The length of time that the patients were in hospital before returning to some form of duty or discharge from the army naturally varied within wide limits (from one to twelve months), the average being four and a half months. The period of stay under our care averaged three months, depending on the condition present, and in nearly every case this was in proportion to the deformity.

The disposal of the patients on the completion of treatment is set forth in Table V.

It will be seen that out of fifty-eight cases which were discharged from hospital, fifty-two were considered fit for some form of duty, and the great majority eventually for full duty. Only six cases were discharged from the army. These were considered unfit for further military service for the reasons given in Table VI.

TABLE VI

Name	Reasons for discharge from the Service	Present occupation
Pte. J. W. L...	Chest in good condition. Totally blind in right eye, with considerable pain, due to gunshot wound, and deaf in the right ear.	Munitions, 52 hours per week.
Pte. C. K.....	Chest in fair condition. But he had pronounced debility.	In hospital in Canada.
Pte. H. G.....	Extensive destruction of the left pectoral muscles at the time of injury. Inability to use left arm	In hospital in Canada.
Pte. W. C.....	Spondylitis deformans. Age 51.....	Light work, 45 hours per week.
Pte. W. T. B...	Pronounced deformity of chest, with displacement of the heart	Farming, 28 hours per week.
Pte. E. W. S...	Pronounced deformity of chest, with displacement of the heart	

Of these cases, therefore, only two were invalided from the army on account of conditions directly attributable to the intra-thoracic condition.

The after-history has been determined so far in thirty-nine of the cases discharged. Examination of Table V shows that, of the thirty-four cases retained in the army, who have been traced, eighteen

(53 per cent.) are doing full duty; seven (20 per cent.) have been lowered in category; two (6 per cent.) remain in Category B as on discharge from hospital; five (15 per cent.) are still in training at command depots; while two (6 per cent.) are not available for duty at present. The present occupations and length of work per week of five cases who were discharged as permanently unfit are given in Table VI.

It is apparent that injury to the chest is not necessarily a conspicuous factor in invaliding soldiers from the army. Even when they are discharged from the army on account of the results of such an injury, they are still capable of doing a considerable amount of work each week in a civilian occupation. Amongst those cases which are not discharged from the army as permanently unfit, there is a good per centage who eventually return to full duty with little or no impairment in the degree of physical exertion which they are able to accomplish.

#### CONCLUSIONS

1. Deformity of the chest wall is a very important disabling after-effect of gunshot wounds of the chest.
2. This deformity follows most frequently prolonged involvement of the pleural cavity.
3. The early and persistent evacuation of fluid from the pleural cavity, either by aspiration or by operation, is of great importance in preventing the development of the deformity. Especially is this so in cases of hæmothorax.
4. The early use of special exercises is beneficial in preventing or overcoming this deformity.
5. The prognosis in this condition is exceptionally good under suitable treatment.

## MEDICAL INSPECTION OF SCHOOL CHILDREN

BY D. J. DUNN, M.D.

*Medical Inspector of Schools, Edmonton, Alta.*

IN introducing the subject of medical inspection of schools to this audience, I consider it a privilege and honour to do so, because I am satisfied that there is no other body of men as much interested in the welfare of the human family physically, mentally and morally, and who have the same opportunity to assist in the development of the human race along proper lines. For the assistance which the medical and dental professions have given and are giving to the accomplishment of these objects, allow me to thank you most cordially, as there has been no change in my attitude in this regard since the commencement of the work here.

At the beginning of the work, I felt as I do now that the amount of success obtained is in direct ratio to the amount of co-operation and assistance given the department by all those who have anything to do with the school pupils. The subject of medical inspection of schools covers a very wide range of thought and action, and is a topic so big and comprehensive that its discussion in a single paper can only be suggestive, with perhaps a little more stress laid upon some features of the work which have been more prominent than others during the time the work has been carried on here. Many practical men do not see the necessity of medical inspection of schools, of school nurses, of schools for mentally abnormal pupils, nor for any other innovations which have come to stay, and have become an important part of the world's progress and which should be assisted by all right minded and progressive individuals.

We hear a great deal of talk at the present time about the conservation of our natural resources, and rightly so, but that subject as discussed gives very little if any place to the conservation of the greatest asset of any nation, which is its children. What is the use of conserving our natural resources without giving due thought to the succeeding generation who are to use them?

"A sound mind in a sound body" is the ideal kept before us in

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Read before the Alberta Medical Association, September 21st, 1916.

our work, and so to influence the generations as they pass along. An ideal which has impressed itself very strongly upon everyone who has gone into the subject carefully. However, it is to be hoped that before many years have passed, we will have the satisfaction of seeing our ruling bodies give as much care and attention to the rising generation as they now give to the development of the best strains of live stock. The only hope that this may be realized will be by such a body of men as I am now addressing, using their influence by word and act to bring this subject to the notice of the proper authorities. I am pleased to say, however, that the Government of Alberta has, during the past session, voted a sum to make a start along one branch of this work: that is the care of the mentally defective.

There never has been a time in the history of our country or of the empire when the conservation of the rising generation has been of as great importance as at the present time, when so many of the flower of our manhood and womanhood are laying down their lives in the cause of righteousness and freedom. This phase of the subject is all the more important in view of the fact that at the present time there is such a high percentage of loss of young lives before they even reach school age. What do the vital statistics of our city for 1914 tell us?

Out of a total of 608 deaths, 323 or over 50 per cent. occurred before five years of age.

Under one year, 287, or 47·2 per cent. of the total.

Between one and four years, thirty-six, or 53·12 per cent, before five.

Between five and fourteen, twenty-two, or 56·74 per cent., before fifteen years of age.

For the Province of Alberta for the year 1914 out of a total of 4,147 deaths, 1,738, or 41·66 per cent. occurred before the children were five years of age.

Under one year, 1,376, or 33·18 per cent.

Between one and four, 362, or 41·66 per cent., before five years.

Between five and fourteen, 224, or 47·31 per cent., before fifteen years.

Over 33 per cent. of the deaths occurred before the age of one year, and over 47 per cent. before the age of fifteen years.

These figures convey to my mind a serious state of affairs, and one which demands and is worthy of our very best endeavours to combat. This is especially true when a very large proportion of these lives could be preserved by those in charge being better informed as to the care of these little ones.



When such a large percentage of children die at this early age, it is all the more important that the health of those living should be well looked after. We may safely assume that many who live are badly maimed, and a proportion of these in later life will not be able to make their own way and thus become a charge on the community when they should be a tangible asset.

Medical inspection of schools is one branch of preventive medicine which has not yet come to its own, not saying that any branch of prevention has received the recognition that it should; but it seems very difficult to have individuals, let alone a community, appreciate what it has missed. In all medical inspection work the object to be kept in view seems to me to be to place every pupil who enters school in the best possible position to get the most out of his or her time there, or to put it in another way, to assist those in good health to keep up to the highest standard and assist those below normal in any way as much as possible, so as to give them the best chance they can be given.

We may ask ourselves the question: Should we allow the child to suffer and perhaps be handicapped for life through the ignorance or indifference of the parent? I do not think any of us would answer this question in the affirmative. We all know that this is the children's generation, and it is not very many years since the treatment of children received but very little attention. These children are the future parents and many of them would have a right to rise up and curse their parents as well as all others responsible for not doing their duty by them. When physical defects are interfering with the health and school progress of the pupil, authority should be given to see that the necessary treatment is carried out if the parents will not assume the responsibility. No cases here have gone untreated because the parents were poor.

The medical profession have done their part nobly. The pathetic side of this picture is that many parents whose children require treatment the most, appreciate it the least. This prejudice, however, is being gradually overcome, and parents are appreciating more and more what the department is endeavouring to do for their children.

Sickness and physical degeneracy more than any other single factor it has been said, is the cause of social dependency. In order to cope with present conditions and be able to maintain a livelihood, each individual must have a *sturdy physique* and be *prepared*. Physical defects retard mental development and prevent persons from being properly prepared for the battle of life. A very large

percentage of our school children suffer from decayed teeth and deformed mouths. The next most frequent defects being impaired throats and vision. Decayed teeth mean aching teeth, aching teeth mean germ-ridden mouths and germ-saturated food favouring the propagation of contagious diseases, poor mastication and digestion, impaired nourishment and bodily resistance, intestinal and general toxic absorption, all of which prevent proper intellectual advancement, and favour the various forms of physical disturbances and degeneration. Sir William Osler said in the *Lancet*: "If I were asked to say whether more physical deterioration was produced by alcohol or by defective teeth, I should unhesitatingly say, 'defective teeth.' It has been abundantly proved in Germany that where children's teeth are in good condition 'they become physically stronger, secure a higher average in their studies, and are easier to control and apparently happier.'"

Physical defects have a distinct bearing on school progress. If we assume that the average child without defects of any kind will complete the eight grades of the public school in eight years, how long will it take the physically defective child to complete these eight grades? A pamphlet issued by the Russell Sage Foundation on this subject brings out the following facts:

Physical defects present:

Defective vision.....	8 years.
Cariou teeth.....	8½ "
Enlarged tonsils.....	8 7-10 years
Adenoids.....	8 1-10 "
Enlarged glands.....	9 2-10 "

It is a matter of common observation that the brightest and most studious children have defective vision, but later disaster overtakes the child if the defect is not remedied.

Quoting again the Russell Sage Foundation: "Our expenditures for public education have more than doubled in the past ten years. No other investment produces so large a return. More money means better schools, better schools mean better citizens, better citizens mean more money. It is a benefit circle." It also came to the conclusion from its investigations that pupils were retarded from six months to one and a half years by a single physical defect. In the city of New York, during the first half-term of 1913, 189,840 children did not pass into the proper grades. Much of this was considered due to physical defects, including defective

teeth. The cost of re-educating these children, as we might term it, was \$3,679,304.40. London authorities claim that it costs \$25.00 per annum to educate one deaf child, whereas the normal child can be educated for \$14.00.

The figures I have quoted for New York are very large, but we have the same conditions here, only in a very modified degree. What does this cost our community then in dollars and cents, leaving out all other considerations?

In 1915 there were about 1,100 pupils reported for defects, exclusive of defective teeth. Taking the average cost of the child per school year say at \$40.00, which I believe to be not far astray, as Toronto has worked it out at about \$31.50. Our 1,100, which is exclusive of defective teeth, assuming one year's retardation, costs the community \$44,000.00. If this is the case, it certainly would pay the community to have these cases treated and pay much more than the ordinary fee charged by any medical man to do the work.

Is it fair to our children to allow any of them to waste one or two years of school life besides running the risk of incurable damage to physical development, their beauty, and their efficiency?

As to the doing of this work, there seems to be a difference of opinion as to how it should be carried out. It is probably the consensus of opinion that in a broad, general way the medical inspection of schools, except in the case of those diseases which menace the public health, is best carried on by the education rather than by the health authorities. Of course, the educational authorities should work in thorough harmony with the health authorities, and all health laws should be absolutely observed.

However, the main thing is *to do the work and to do it at once*. The above is the method which has been adopted here, and thus far has given good results. When the city health department discovers a case of contagious disease, the medical inspector of schools is at once notified, and the principal of the school in the district affected notified by mail. If a suspicious case comes under the notice of the school authorities, the city health department is notified. This immediately puts both departments in touch with these cases. Before returning to school after contagious disease, the pupil must present a certificate from the city health department.

It would be very unfair and practically impossible to leave this phase of the work without making a reference to the work of the "school nurse." She is our ablest assistant, without whose help a great proportion of our work would be in vain. In her contact with the parents and homes; persuading the parents to do

what they should for their children and giving instructions as to their care and to the general hygiene of the home, she is doing something which should be of great benefit in the future.

Another feature of this work which is of vital importance is dealing with the mentally abnormal child. The line between normal and abnormal pupils is an invisible one, and many of these could be well taken care of in special classes. As soon as the boards of education and the general public realizes the amount of time spent upon these with little or no result upon the pupils, other provision will be made for dealing with them. There is of course also the class who should not be admitted to our schools, but should be confined to an institution where they can be under supervision. Many of them may be prepared to be at least partially self-supporting. By dealing with them in this way, we eliminate the danger to society, as many of the children of such parents are mentally deficient. The children of any parents *may* be mentally abnormal, but the children of mentally deficient parents are *almost certain* to inherit this tendency.

Between 2 per cent. and 3 per cent. of the school population is defective mentally; that is more or less below normal intelligence. A very large number of children appear to be defectives, but are soon raised to a perfectly normal standard by having such physical defects as adenoids, deafness, visual abnormalities, etc., corrected, but about 2 per cent. will remain mentally abnormal, even after all physical defects are relieved. Of course, in every school-room there will be found children who are older than they should be for the grades they are in, owing to many causes, but the chief being irregularity of attendance due to illness, or having not had the opportunity to attend school. "Ayers" says that irregular attendance is the chief cause of backwardness in school and that non-promotion and ill-health are the chief cause of irregular attendance. These repeaters, as they are called, whether mentally defective or not, are apt to drop out of school early from discouragement and then join the ranks of the uneducated classes with a poor prospect before them, and many of them sooner or later drift into the criminal class of the community. When such children are placed in a classroom with reasonably normal and bright pupils, the teacher has to neglect either one or the other. It is impossible properly to educate them both at the same time, and consequently the child who is subnormal is usually neglected and stays in the same room term after term, to the disgust and discouragement both of teacher and scholars. Besides this, such



children are usually ill-tempered, vicious, upsetting the discipline and progress of an entire school-room. This is not justice to the teachers, to the scholars, or even to the poor defective himself. It is as clear as the noonday sun, that such children should be educated by themselves, where under special teachers, conditions and environments, they may be made to produce the best that is in each individual child. Therefore, there should be established in all towns and cities, schools for defectives, devoted exclusively to the uplift intellectually, physically and morally of defective children. These children should be educated either in separate buildings away from other children, or if this is not practicable, separate rooms set aside in the school buildings for their education. No school of this nature should accommodate more than twenty-five pupils, and a less number would be better. Teachers specially qualified for this class of work should, of course, be engaged and receive remuneration in accordance with the trying duties they have to perform. Many of these pupils could later on return to the public schools and to the grades to which they are best adapted. It is estimated that 25 per cent. of the inmates of feeble-minded asylums could be made normal by correction of physical defects and proper training, and that 40 per cent. could be made semi-normal.

Some people believe that it is foolish to waste time with feeble-minded and weakly children. How would any of these people feel if the life of his or her own child was at stake? It is certainly our duty, to prolong life and to alleviate human suffering and to see that those who live are made as strong as possible.

Go to a watch, gun, or instrument factory, and see what care is taken in inspecting each piece of material which is to go into the formation of the article. Nothing is neglected to procure the article of perfection. Are we as careful with our children to see that their bodies are made as perfect as possible? I fear not, and yet how much more valuable is a child than either a watch, gun, or a fine instrument, and how much more important it is that he should as nearly as possible reach physical, mental and moral perfection.

Whatever the expense of this work may be, it is cheaper, and better, and nobler to educate properly in suitable buildings, and to produce and maintain a high health standard, than it is to educate them under reversed conditions and to pay the money supporting criminal courts, reformatories, jails, hospitals, institutions, for the deaf, blind, and dumb, crippled, mental defectives, paupers, etc., etc., even if we have no ambition to produce a stronger race as one generation succeeds the other.

It must not be forgotten that a strong, virile, intellectual people is one of the greatest assets a nation can possess, not only in times of war, but also in times of peace, and each individual community should be willing to do its share in the general uplifting and improving and strengthening of the nation as a whole.

Nor does our obligation stop with our duty to the individual child. We are educating a nation. It rests with us to say whether the next generation shall become stronger than the one before; whether the race shall advance or retreat. The changes will very largely be brought about through the agencies of the public schools. Here the children come together and mingle, here they spend a very large proportion of their waking hours, here they receive the training and are surrounded by the environments which shall influence them in later life and where they begin to understand the nature of British citizenship. If, therefore, we wish to produce and perpetuate a nation of strong, virile, intellectual, and normal men and women, let us see to it that our public schools are in every way of the best possible character, and that they shall be improved from year to year to keep pace with modern methods and advanced science, for surely nothing is too good for the coming masters and mistresses of the nation.

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THE Hon. J. R. Boyle, minister of education, has appointed a board of examiners to make arrangements for holding the provincial examinations for nurses the first week in October. These examinations will provide means whereby nurses who have become residents of the province since the passing of the Registered Nurses' Act may become eligible for registration. Graduates of Alberta hospitals who were in training at the time of the passing of the act are not required to take the examination. Dr. Revell, dean of the faculty of medicine of Alberta University and president of the Alberta Medical Association, was appointed permanent chairman of the Board.

## Editorial

### THE NEED FOR CONSCRIPTION OF CANADIAN DOCTORS

THE recent passing of the Man-Power Bill in the United States has a direct interest to all Canadians who are keenly following the events of the War. To many of us it seems as though our American friends have seen and profited by our mistakes before we were willing to remedy the shortcomings of our lack of system. Our efforts have undoubtedly been great, but they have been to a great extent stultified by clinging so long to voluntary methods of securing the assistance the country needs. To no class of men does this apply as much as to doctors because the supply is limited and the demands great for both army and civilian needs.

The effect of the recent statute in the United States is to make all men between the ages of eighteen and forty-five liable to be drafted, with no limitations owing to marriage or personal responsibilities. How this will concern the supply of doctors is what chiefly concerns our readers. That it will have the effect of taking into the service more of the city and town physicians between the ages of thirty and forty-five is assured. This is the class that has hung back in America and Canada under the voluntary system. To these men undoubtedly fall the heaviest sacrifice when they leave their local work for a number of years. This would largely be made up, however, by the large earnings they have had since the War began, owing to the absence of so many of their confrères on active service. This is the class that must come forward to meet the pressing demand for doctors from now until the close of hostilities.

In Canada the voluntary enlistment of doctors has had the effect of leaving large sections of our population without

the aid of a physician within reasonable distance, and other sections with as many as they had before the War. This condition of affairs is intolerable if the country is to do its duty to our soldiers and civilians. The cleaning out of the country doctors in localities where the work is hard and the exposure great is undoubtedly due to the advantages the C.A.M.C. has to offer and to the fact that a practice in these districts may be secured with little effort after the War.

Great Britain had the courage to tackle this problem when it had reached a stage somewhat similar to what prevails in Canada to-day. This was done by conscripting the services of all physicians up to the age of fifty-six years. By the amendment to the Military Service Act of Great Britain passed last March, all doctors up to this age must either serve in the Army or practise their profession where the Minister of National Service thinks they are most needed.

The profession in Canada has been willing to have legislation passed that would remedy these defects and at the same time supply the medical officers needed for the Army. The Canadian Medical Association at its annual meeting in June, 1917, passed a resolution urging the Dominion Government to provide legislation conscripting the whole of the medical profession of Canada to supply the needs of the army and the civilians. Why the Government has taken no action in this matter is not generally known. It is probably due to its not being aware of the lack of doctors in some country districts and to the fact that the needs of the army for the past few months have been met by the conscription of the recent graduates of the universities. The medical school, however, cannot turn out doctors fast enough to provide the reinforcements necessary for the military work overseas and in Canada. The Medical Corps is so big now that the losses through death, wounds, and sickness necessitate a considerable number being sent over every month. In addition, men must be sent over to replace all the doctors returned to Canada for duty.



The profession themselves seem to have suggested the remedy for the trouble. The ideal solution would be to have the whole profession conscripted for service. Those doctors essential for civilian needs would be placed on the Reserve until their services were required. The outlying points where the need of doctors is urgent could be supplied by volunteers who would rather serve in private practice than do military work. If this failed to secure the required number for country work, some might be released from the C.A.M.C., subject to the condition that they practice in places designated by the authorities as badly in need of their services.

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TORONTO is planning, on a huge scale, the reconstruction of St. Andrew's College into a military hospital. The present arrangement calls for an erection of twenty-five new buildings furnishing accommodation for over two thousand beds. The expenditure is estimated at \$2,000,000. The hospital wings will be built in two clusters; one for convalescents, the other for hospital cases. Five convalescent cottages are planned with accommodation for nine hundred beds. A vocational building will be erected and also therapeutic and active treatment hospitals. The other buildings will be the hydro-therapeutic, surgical and neurological hospitals, and the administration, medical officers' and nurses' quarters. The ground covered will be twenty-five acres. The hospital, when completed, will be of a similar type to those the United States and French Governments are building. While it is not intended to be of a permanent character, it will be used for at least ten, or even twenty years, after the conclusion of the war for the treatment of invalided or incapacitated soldiers. The plans have been ratified by the Department of Public Works and the military authorities call for its immediate erection. When completed, the hospital will be the finest of its kind on this continent, and will also be the great demobilization centre for the whole of Canada.

THE Canadian Red Cross has recently opened in Boulogne a Nursing Sisters' Rest Home for the comfort and convenience of the members of the nursing service. The whole environment is essentially home-like and restful, and the situation ideal. The primary purpose of the hostel is to provide accommodation for nurses travelling from England or France on duty or on leave. The facilities of this institution are extended to Nursing Sisters from Canada, Australia, South Africa, the United States, and the United Kingdom, and already several hundreds have enjoyed its hospitality. Colonel Blaylock, Commissioner of the Canadian Red Cross Society in London, first recognized the need for such an hostel, securing its establishment after obtaining the consent of the British authorities.

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THE annual conference of the Canadian Association of Nurse Education and the Canadian National Association of Trained Nurses was held this summer in Toronto, at which were assembled nurses representing the whole of Canada. The conference lasted five days and about one hundred and fifty visiting delegates were in attendance.

MISS DEANS, a member of the National Committee of the Red Cross Service in the United States, gave a most interesting paper, stating that the nursing organization was so complete in every detail that a test made in 1916, in mobilizing a base hospital, was successfully met within twenty-four hours; the nursing personnel and physicians on the scene, tents set up and equipped, and all made ready to receive five hundred patients.

DR. HELEN MACMURCHY's paper on "Universities and the Nursing Profession" quoted letters from Canadian universities touching on the desirability of giving university training to nurses.

## Obituary

### DR. JOHN TAYLOR GILMOUR

GENERAL and deep regret is felt over the sudden death of Dr. John Taylor Gilmour, of Toronto, which occurred on July 29th. He was strolling in his garden in the morning when he succumbed to an attack of heart failure. Dr. Gilmour was a public servant of whom the province might be proud. Prison reform in Ontario owes much to his judgement, intelligence, and kindness of heart. During the past twenty years his whole time has been given to the problem of handling men whom society has put behind the bars. Dr. Gilmour was warden of Toronto Central Prison from 1896 to 1913, and warden of the Ontario Prison Reformatory at Guelph, which has become a model for similar institutions in many parts of the United States. The reformatory was a new departure in prison life, and under Dr. Gilmour's regime many methods of reform were realized and splendid results obtained. He believed in the remedial effects of kindness, and held that the prison should not be a place of punishment, but a means of bringing the offender back to decent citizenship. He was regarded as an authority on the question and advocated his views in many letters and writings. He gave the Hon. W. J. Hanna the heartiest support in the great and successful experiment at Guelph. In 1904 he was President of the Warden's Association of the National Prison Congress. In 1908 he was elected President of the American Prison Association, being the first Canadian to hold this position.

Dr. Gilmour graduated from the medical faculty of Trinity University in 1878. Although he stood aside from politics after the wardenship, he had been previously Liberal member of the Legislature for West York from 1886 to 1894, when he became Registrar of Deeds for York. Last year he was appointed Commissioner of Parole for the Ontario Government, an office he was peculiarly well qualified to fill.

He is survived by his widow and two children, a son and daughter—the former is Lieutenant-Colonel Charles Gilmour, C.A.M.C., who has seen so much service overseas. To these a widespread sympathy is extended. But none will mourn him more deeply than those in whose service he spent a large portion of his life, and who owe that priceless gift, the restoration of self-respect,

to his firm belief that the power of kindness brings out the good that lies at the heart of every man. His most lasting memorial lies in the distinction of being known as the prisoners' friend.

THE death of Dr. John E. Somers, which took place early in July, at Cambridge, Massachusetts, comes as a great loss not only to the community in which he resided, but to St. Francis Xavier's College, of which he was a generous benefactor and lifelong friend. He was born in Antigonish on September 5th, 1851. He attended St. Francis Xavier's College and thereafter taught in the public schools. He subsequently entered Harvard University and completed his course in Bellevue Medical College, New York. He eventually took up his residence in Cambridge, Mass., and for many years devoted himself almost exclusively to surgery. He was deeply interested in the Holy Ghost Hospital for Incurables, gave this institution much financial assistance, and was head of its medical staff. In 1905, St. Francis Xavier College, on the occasion of its fiftieth anniversary, conferred upon him the degree of LL.D.

It is in connexion with his benefactions to the College that the name of Dr. Somers will be loved and cherished. The two splendid buildings erected by him on the college grounds—the Somers' Chapel and the Somers' Gymnasium—in which he linked up the moral and physical well-being of the students with the development of their intellectual life, are fitting memorials of his well-balanced sense of true university education. To these donations must be added the establishment by him of a Chair of Classics in the same college in 1913. The enthusiasm he felt for the welfare of this institution he communicated to others. He was known far and wide as a physician of high standing, and a public spirited citizen who gave freely of his time and energy in behalf of all.

CAPTAIN JAMES TENNANT WHITWORTH BOYD, C.A.M.C., died on service at the age of twenty-seven; nephritis was the cause. He was born in Nova Scotia, and graduated M.D., C.M. at Queen's University, Kingston, in 1914. He was the son of the Rev. Andrew Boyd, of Port Arthur, Ontario. After serving for a year in the Kingston General Hospital, he enlisted in the Canadian Army Medical Corps and went overseas in 1916, being drafted to the No. 7 Canadian General Hospital (Queen's University Unit) at Etaples. He worked in the laboratory there till February, 1917, when ill-health necessitated his return to England. During the past fifteen



months he had been a member of the laboratory staff of the Kitchener hospital.

A SAD accident took place in the vicinity of Sudbury, when Dr. E. J. Leary lost his life by drowning. He was twenty-eight years of age, and a native of Cooksville. He was a member of the 1917 medical class of Toronto University, and, after graduation, he enlisted with the C.A.M.C., with which he saw two years' service in France. At the time of his death he was attached to the medical staff of the Canadian Copper Company.

THE Gatineau valley mourns to-day the passing of one of its most esteemed citizens in the death of Dr. James Pritchard. The doctor had undergone an operation in March from which he never fully recovered. A cold, contracted recently, caused congestion of the lungs and his ultimate death. He was a graduate of the school of medicine, Toronto University, and an honour graduate of McGill University. He was a prominent member of the Masonic Order. Dr. Pritchard was in his forty-ninth year, and had been practising medicine in the Gatineau valley for the past quarter of a century, where he will be sadly missed for his many excellent qualities, and for his big, bluff, genial ways which endeared him to the hearts of all.

MUCH regret was felt at the sudden death of Dr. Frank Mitchell, the result of a nervous breakdown occasioned by his long and continuous studies and war work. He was born in Meaford some twenty-five years ago, had only passed his final examination in May last, and was practising at the Asylum charge of a Convalescent Home at the time of his death. When war broke out he enlisted with the navy and was in active service for two years, returning about a year ago to complete his course. Owing to his service overseas, Dr. Mitchell was favourably recommended for special convalescent work. He was considered to have a brilliant future before him.

## Miscellany

### News

#### ALBERTA

FIFTEEN municipalities throughout Alberta are reported so far as desirous of taking advantage of the rural hospital legislation in the province, and these have made application to the minister of public health. The largest municipal hospital yet arranged for will be at Wainwright, where a scheme is now leading up to definite action. Vermillion, Mannville, and Lacombe are also getting their organization under way, and will build or otherwise arrange for hospital premises this year.

DR. J. C. MILLER, director of technical education of the province of Alberta, and principal of the institute of technology and art, in Calgary, where the province is training returned soldiers, has been called to the service of the federal board of vocational education of the United States to assist in re-educating its own disabled soldiers. He is severing his connexion with Alberta to accept the new post.

THE first meeting of the council of the Alberta Association of Graduate Nurses was held recently at the Royal Alexandra Hospital, Edmonton. The report of the registrar was most satisfactory. There are three hundred and ten active and non-active members, of which a large proportion of the latter class are serving overseas. The council decided to offer to the board of management of each hospital in the province containing a hundred or more beds, a scholarship of \$25 to be awarded annually to the pupil nurse making the highest percentage in practical work.

INCREASED provision for the care of tubercular discharged soldiers has been made in the three Western provinces and the latest departure is the new sanatorium to be erected at Bowness. Accommodation for about three hundred or four hundred patients is to be arranged in a series of thirty-two and fifty bed pavilions of the type suitable for ambulance cases, while infirmary accommo-

dation in proportion will also be added, the site being laid out with a view to ultimate expansion of five hundred beds. The sanatorium is the outcome of an arrangement between the Department of Soldiers' Civil Re-establishment and the provincial government, and it will be adaptable to the province's civilian requirements after the war.

### MANITOBA

THE Northwestern Manitoba Medical Association held its annual meeting on July 10th. A large number of practitioners from other fields were present and a most interesting session was the result. The President, Dr. O'Brien, was in the chair. Dr. Fryer, of Virden, gave a paper on "Clinical methods and diagnosis", and Dr. Goodwin, of Elkhorn, presented several clinical cases from which developed interesting discussion. The officers elected for current year are: honorary president, Dr. O'Brien, Rosburn; president, Dr. F. A. Smith, Birtle; vice-president, Dr. Hudson, Hamiota; secretary-treasurer, Dr. Tisdale, Kenton; committee, Dr. Andrews, Minnedosa; Dr. Swallow, Russell; Dr. Fryer, Virden.

THE half-yearly report of the Brandon Health Department has been submitted by the health officer, Dr. E. S. Bolton, and Sanitary Inspector Davies to the City Council. It shows the health conditions of the city as a whole satisfactory. There were no cases of typhoid fever during the last half-year. The total number of cases of infectious diseases reported were ninety-seven, of which fourteen were outside cases. Diphtheria had but one death. There were no deaths from the usual infectious diseases. Three deaths occurred out of ten cases of tuberculosis. The low sickness and mortality rates were due to the improved sanitary enforcements. The decrease in the infant death rate was a source of great satisfaction. It had been decreased by fifty per cent. when compared with the figures of 1917. This was due to the milk supply which was very satisfactory and there was no scarcity at present. Of the dairies inspected only one had to be regulated. The valuable co-operation of the Mayor, Magistrate Fraser, Mr. Kenneth Campbell, of the Children's Aid Society, and the Chief of Police had been of the greatest service to the Health Department and had been instrumental in bringing about improved conditions.

DR. A. J. DOUGLAS, the Winnipeg city health officer, is urging

the city to take steps for the erection of a small-pox pavilion on the grounds of the King Edward and King George hospitals on the plea that it would be more satisfactory, just as safe, and vastly cheaper than if isolated in some out of the way locality. He stated that the fundamental trouble was non-vaccination. He stated that diphtheria had caused the health department more trouble than any other disease. Sixty eight deaths resulted from 1,467 cases. In 1916 the deaths were 50 out of 1,281 cases. Carriers reported were 336 in comparison with 232 the year before.

### SASKATCHEWAN

THE eleventh annual convention of the Saskatchewan Medical Association closed July 18th. The election of officers resulted as follows: President, Dr. J. V. Cornell, Regina; first vice-president, Dr. Hart, Indian Head; second vice-president, Dr. Valens, Saskatoon; secretary-treasurer, Dr. Turnbull, Regina; executive, Drs. Rothwell, Regina; Ramsay, Moose Jaw; and Wright, Saskatoon.

Dr. Blanchard, of Winnipeg, gave the concluding address on the work of the C.A.M.C. in France.

A. B. Cook, president of the Saskatchewan Anti-tuberculous League, accompanied by about a hundred citizens of Regina, recently conducted an inspection of the Sanitorium at Fort Qu'Appelle. The Sheriff gave some idea of the work that is being done by the league in his remarks to the assembly. He spoke of the dangerous menace of tuberculosis to Saskatchewan. In that province there were approximately 25,000 cases of active tuberculosis and the death rate was one a day. It was an alarming but a correct thing to say that seventy-five per cent. of the people of this country have tuberculosis, not necessarily active, but in the system, merely waiting a favourable opportunity for development.

He outlined present conditions of the Sanitorium and the extensions and improvements which were being planned. He stated that both provincial and federal governments had been generous in the matter of grants. The provincial government has given \$210,000, and will give about \$150,000 this year. So far the federal government has not actually made a grant, but would give \$175,000 this year. Sheriff Cook concluded by stating that there would be as time went on, an increase in the number of patients unable to afford the cost of treatment and they were asking the government and the municipalities to guarantee the cost.



At the examinations for the school of medicine, in July, at the University of Saskatchewan, twenty-two candidates from the province were enrolled. Four for medicine, eleven for dentistry, seven for veterinarians.

DR TURNBULL, medical health officer of Moose Jaw, states that after seventeen months, the epidemic of measles is apparently over. The average number of cases during the last five weeks has been only one per day, the end of the epidemic coinciding with the closing of the schools. For the month of July the birth rate in the city has been 23.49 per thousand per annum, of the estimated population. The total death rate had been 8.9 per annum. Infantile deaths had been 122, which was the highest rate this year and above the average for the past two years. There had been an increase in tuberculosis, there having been already fourteen deaths from this disease in 1918 as compared with eleven for the whole of last year. In the Child Welfare department twenty-seven new cases had been placed on the books entailing one hundred and five visits from the district nurse.

REGINA'S city health department resumed this summer and extended the Baby clinic. Three clinics were held weekly and in different parts of the city, to which mothers were invited to bring their children for examination. A doctor and nurse were in attendance at each.

MISS TRAQUAIR, previously matron of the Military Isolation Hospital, together with Miss Gilroy and Miss Bunn, who have been on the staff of the Ross Military Hospital, left Regina for Winnipeg, in command of Miss Sheppherd, who had previously occupied the responsible positions of matron of St. Chad's and of the Saskatoon Military Hospital. All are going to secure equipment and expect to leave for duty overseas in connexion with the C.A.M.C.

#### ARMY MEDICAL SERVICES

THE following are among the officers brought to the notice of the Secretary of State for War for valuable services rendered in connexion with the war: Colonel G. W. Badgerow, C.A.M.C.; Major C. Macpherson, M.D., Royal Newfoundland Regiment; Colonel A. Primrose, C.A.M.C.

CAPTAIN A. S. HAYCHE, who has been with the Royal Army Medical Corps shortly after the outbreak of the war, and who was wounded three times on May 28th, has been awarded the Military Cross, with an extra bar, for conspicuous bravery under fire. Captain Hayche graduated in medicine from McGill University.

TEMPORARY CAPTAIN FRANK MUIR WALKER, M.B., R.A.M.C., received the Military Cross for special devotion to duty under fire, from Prince Arthur of Connaught, who distributed a number of medals and decorations to Canadian soldiers on his recent visit to Toronto.

LIEUTENANT-COLONEL W. G. ANGLIN has been appointed chief medical examiner for the Kingston district for the Board of Pension Commission.

THE medical staff of Carling Heights has been reorganized, and Captain J. Johnston is appointed senior medical officer of the Western Ontario Regiment, assisted by Lieutenants D. G. Brain, W. P. Boles, M. C. Morrison and C. W. Pennecott; Major W. A. Burgess is detailed for duty as medical officer for the district depot, vice Captain C. M. Keiller.

NURSING SISTER LLOYD has been appointed in charge of a new hospital that is to be opened up at the Aviation Camp at Deseronto, under the direction of the Royal Air Service.

MAJOR KENNETH MUNDELL is to be appointed to the command of a new hospital, to be known as the Rathbun Military Hospital. All R.A.F. cases will be treated there, and removed for convalescence.

TEMPORARY CAPTAIN E. L. WARNER, C.A.M.C., relinquishes his appointment as Deputy Assistant Director of Medical Services. Lieutenant-Colonel E. J. Williams, D.S.O., to be temporary Colonel. Temporary Lieutenant-Colonel D. Donald to command a Canadian Stationary Hospital, vice Lieutenant-Colonel G. D. Farmer. Temporary Major T. H. Macdonald to be temporary Lieutenant-Colonel. Temporary Major W. M. Hart, M.C., to be acting Lieutenant-Colonel whilst commanding a special hospital. Temporary Captains to be temporary Majors: H. Orr, S. J. Streight, F. W. Tidmarsh, R. Pearse. Temporary Major E. V. Hogan to be temporary Lieu-

tenant-Colonel. Temporary Captain G. Shanks resigns his commission. Temporary Lieutenants to be temporary Captains: J. R. Brais, A. F. McGregor, C. A. Wells, J. W. MacKenzie, N. W. Pury, A. E. Mackenzie, J. H. Howell, Y. Blayney, J. W. Reddick, P. D. McLarren, C. G. Sutherland, H. A. Des Brisay.

CAPTAIN EDGAR DOUGLAS, C.A.M.C., Vancouver, has been awarded the Military Cross for directing his relay of bearers under heavy shell fire, and, though wounded, remaining on duty until relieved.

THE following Canadians of the Army Medical Corps have been awarded the Meritorious Medal: S.-Sgt. J. R. Surman, C.A. M.C.; Pte. T. F. Lean, C.A.M.C.; Lce.-Cpl. C. F. Davis, C.A.M.C.; S.-M. C. H. Ward, C.A.M.C.; S.-Sgt. J. B. Riddell, C.A.M.C., Cpl. (A.-Sgt.) P. Riley, C.A.M.C.

DR. McCORMICK, of Toronto, who has been missing for some time, is now reported a prisoner in Germany, a cable having been received from him a short time ago. He obtained a commission in the Royal Army Medical Corps and in 1917 proceeded to France. He was at first attached to the 25th Field Ambulance, and later appointed medical officer to the 2nd Battalion, Lincolnshire Regiment, to which unit he was attached at the time he was taken prisoner.

#### CASUALTIES

##### *Died of Wounds*

CAPTAIN W. F. McISAAC, C.A.M.C.  
M. A. McKECHNIE, C.A.M.C., of Walkerton, Ontario

##### *Died on Service*

CAPTAIN J. T. W. BOYD, C.A.M.C., of Nova Scotia

##### *Wounded*

LIEUTENANT-COLONEL D. DONALD, C.A.M.C.  
MAJOR G. S. MOTHERSILL, D.S.O., C.A.M.C.  
CAPTAIN J. C. EAGER, C.A.M.C., of Watertown, Ontario  
CAPTAIN J. D. W. H. BARNETT, C.A.M.C.  
W. J. SOBEY, C.A.M.C., of les Gatlos, Ontario  
D. S. CAMPBELL, C.A.M.C., of Woodside, Nova Scotia  
A. E. McKUSKER, C.A.M.C., of Regina  
F. B. LOBB, C.A.M.C., of St. John, New Brunswick

### Book Reviews

**THE SYSTEMATIC TREATMENT OF GONORRHOEA.** By N. P. L. LUMB, temporary Captain, R.A.M.C. 116 pages. Price, 4s. 6d. net. Publishers: H. K. Lewis & Co., 136 Gower Street, London, W.C.

THIS little volume deals especially with the treatment of gonorrhœa and that only in the male patient. This should have been stated in the title.

It has grown out of the so-called "official" campaign against venereal disease. Captain Lumb bases his treatment on extensive personal experience with a large number of cases in military practice.

We wish the book all possible success.

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**THE ACTION OF MUSCLES, INCLUDING MUSCLE REST AND MUSCLE RE-EDUCATION.** By WILLIAM COLIN MACKENZIE, M.D., F.R.C.S., F.R.S.E., member of the Council of the Anatomical Society of Great Britain and Ireland and of the staff of the Military Orthopædic Hospital, Shepherd's Bush, London. 249 pages, with illustrations. Price 12s. 6d. net. Publishers: H. K. Lewis & Co., 136 Gower Street, London, W.C., 1918.

THIS volume is a study of muscular action in health and disease, mainly from the physical standpoint. It does not purport to be a treatise on the physiology of muscular tissue, else we should ask why there is no discussion of the voluntary tetanus, central and peripheral inhibition of muscle or reciprocal innervation. It is, however, a little surprising to find no mention of Professor Sherrington's work on the inhibition of muscular tone. Tonus is recognized, and its relations to so-called muscular rest are fully appreciated, but a full preliminary discussion of muscular tonus and its dependence on innervation would have rendered very clear a great deal that it is referred to in connexion with paralyses and the remedial measures for them.



The book gives valuable information in a department of physiology which teachers do not deal with at all or take for granted. As a matter of fact, there is in medical circles a great deal of ignorance about the very subjects dealt with in this treatise.

The book has many excellent diagrams and photographic illustrations. The remedial methods appropriate to the various disabilities are dealt with fully and in a practical fashion.

We presume that "logical" is a mistake for "physiological" in the following sentence (p. 237): "A relative inequality in action between the right and left sides (of the diaphragm) can be regarded as having a pathological and not a *logical* basis."

D. FRASER HARRIS, M.D.

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A DIABETIC MANUAL FOR THE USE OF DOCTOR AND PATIENT. By ELLIOTT P. JOSLIN, M.D., assistant professor of medicine, Harvard Medical School. 179 pages, with illustrations. Publishers: Lea & Febiger, Philadelphia and New York, 1918.

THIS book is what it purports to be, a practical manual dealing with diabetes.

It includes everything that need be known about the dietetic aspects of this disease. It does not discuss physiological theories of glycogenesis; and Bernard's name does not occur in the index! The amount of glycogen in the liver cannot be called "an extremely small percentage", as is stated on page 51.

It condescends to full details about food for diabetic patients, and has some exceedingly useful tables showing the percentage composition and caloric value of a large number of available food substances. The selected laboratory tests useful in modern diabetic treatment form a valuable appendix. A diagram of the instruments used in collecting and analyzing the alveolar carbon dioxide would have been useful. The type, paper, binding, and general "get up" of the volume are in the best taste.

D. FRASER HARRIS, M.D.

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ANIMAL PARASITES AND HUMAN DISEASE. By ASA. C. CHANDLER, M.S., Ph.D., instructor in zoology, Oregon Agricultural College, Corvallis. 533 pages, with illustrations. Publishers: John Wiley & Sons, New York, 1918.

WE give this volume the heartiest welcome. Its objects can

best be understood from the following quotation from the preface: "It is the aim of this volume to present the important facts of parasitology . . . in such a manner as to make it readable and useful, *not* primarily to the parasitologist, but to the public health and immigration service officers; to the physicians who are concerned with something more than their local practice; to teachers of hygiene . . . ; to college and high school students; to the traveller; and to the farmer or merchant who is interested in the progress of science and civilization."

Among other important things the war has taught us is the importance of science in daily life—accurate knowledge of the visible and invisible worlds in which we move and live. Not all our numerous diseases and worries are due to vegetable parasites or "microbes", many arise from the presence in the body or on the body of animal parasites. Dr. Chandler tells the story of all these in an interesting fashion. There is no excuse now why any educated person should remain in ignorance of the relations of mosquitoes and their animal parasites to human malaria and yellow fever. Much of the book reads like a romance—is a romance founded on Nature's own "ultimate reality". The illustrations are admirable.

D. FRASER HARRIS, M.D.

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TUMOURS, THEIR NATURE AND CAUSATION. By W. D'ESTE EMERY, M.D., B.Sc., director of the Laboratories, King's College Hospital. Price 5s. net. Publishers: H. K. Lewis & Co., 136 Gower St., London, W.C. 1, 1918.

THIS little book is virtually a well reasoned appeal for the recognition of the possibility of the truth of the parasitic origin or causation of cancer. Dr. Emery is a candid, guarded and well-informed writer on the causation of tumours.

There is no index; but it would seem that the views of Sir John Blaud-Sutton on tumours are not reckoned with.

The book must be read carefully, for it is written carefully. It contains no illustrations.

The expression "immunity to" is found on page 97; if "to" must be the word used, let the expression be "resistance to"; we are surely immune *from* things.

**MEDICAL DISEASES OF THE WAR.** By ARTHUR F. HURST, M.A., M.D., F.R.C.P., temporary Major, R.A.M.C.; physician and neurologist to Guy's Hospital. Second edition, revised and enlarged. Price, 12s. 6d. net. Publishers: Edward Arnold, 41 Maddox Street, London, W., 1918.

THIS is one of the most suggestive books which, as medical by-products of the war, has yet appeared. It will be read and referred to long after the war is over. The purely medical chapters—those dealing with the infections, beri-beri, tetanus, soldier's heart, war nephritis and gas-poisoning—are valuable because so completely up-to-date.

But what makes the work so fascinating is the way in which Dr. Hurst—previously well known as Hertz of Guy's—applies his physiological knowledge to the solution of the many problems in the disordered functions of the nervous system which this most violent of all wars has created. Some of these are: emotional neurosis, neurasthenia, psychasthenia, hysterical deafness, and blindness, aphasia, automatism, and even double personality. The great remedial value of hypnotism with mental suggestion is fully established. Dr. Hurst is evidently no blind worshipper at the altar erected to the man from Vienna—Frewd—of whose system he sagely remarks that what is good in it is not new, for the value of confession by a mind diseased has been recognized and utilized from the earliest times.

The howl of holy horror raised by the metaphysicians can be well imagined when they are told that Dr. Hurst takes it for granted in his opening pages that motions and other mental states can be and are, repeatedly, true or “exciting causes” of bodily changes. In some quarters this is a “heretic, damnable error”.

The other points of interest which might be alluded to are: retraction of dendrites of cerebral neurones used to explain certain abnormal mental states, the importance of vitamins in diets, and the great saving of life through inoculation against typhoid fever.

D. FRASER HARRIS, M.D.

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**THE NAUHEIM TREATMENT, IN ENGLAND, OF DISEASES OF THE HEART AND CIRCULATION.** By LESLIE THORNE THORNE, M.D., B.S., M.R.C.S., L.R.C.P., late medical officer London County Council Technical Education Board. Fifth edi-

tion. 160 pages. Price 5s. net. Publishers: Baillière, Tindall & Cox, 8 Henrietta Street, Covent Garden, London, 1918.

THIS is a refreshing book. It proves to us fully that the treatment of baths, etc., known as the Nauheim treatment, can be carried out in England (or for the matter of that, in New England) just as efficaciously as in Germany. This is satisfactory for more than one reason. The value of blood-pressure records is made very evident. The so-called resistance exercises are well illustrated.

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MANUAL OF VITAL FUNCTION TESTING METHODS AND THEIR INTERPRETATION. By WILFRED M. BARTON, M.D., associate professor of medicine, Georgetown University. 311 pages. Price, \$2.00 net. Publishers: R. C. Badger, The Gorham Press, Boston; The Copp Clark Co., Toronto, 1917. Second edition.

THE table of contents of this book promises a rich feast in the realm of modern clinical chemistry. Much of it is valuable, though in the nature of the case a compilation. That the book has proved useful there is no doubt as before us is its second edition.

The laboratory tests in diseases of the liver, kidney, pancreas, and heart are fully dealt with; but nothing whatever is said about diseases of the stomach. We had to look twice at the index to be certain that the word "stomach" did not occur in it. This is a grave omission. The chemistry of disordered gastric function is the oldest branch of clinical chemistry and unquestionably one of the most important.

The much more academic subject of the endocrine glands is gone into thoroughly. Here and there are tiresome allusions to tests or methods which are at once dismissed as too elaborate or obsolete. On page 114. "Wheatstone's bridge" is described as a "whetstone bridge", which is not only nonsense but disrespectful nonsense. Wheatstone's name should at least have had its capital letter.

German and Austrian medicine is quoted just about as much as is bearable in the fifth year of the war.

D. FRASER HARRIS, M.D.



**MEDICAL ELECTRICITY.** A Practical Handbook for Students and Practitioners. By H. LEWIS JONES, M.A., M.D., F.R.C.P., late consulting medical officer of the electrical department in St. Bartholomew's Hospital. Seventh edition. Revised and edited by LULLUM WOOD BATHURST, M.D., physician in charge of electrotherapeutic department, Royal Free Hospital, London. 561 pages, with illustrations. Price, 15s. net. Publishers: H. K. Lewis & Co., 136 Gower Street, London, W.C.1, 1918.

If any one, after going through this book carefully, fails to understand the medical uses and applications of electricity, the fault must be with himself. For the book is very clearly written and splendidly illustrated, there being no fewer than 197 illustrations. The sections on ionic medication and diathermy are particularly valuable.

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**SYPHILIS AND PUBLIC HEALTH.** By EDWARD B. VEDDER, A.M., M.D., Lieutenant-Colonel, Medical Corps, United States Army. Published by permission of the Surgeon-General, United States Army. 300 pages. Price, \$2.25. Publishers: Lea & Febiger, Philadelphia and New York, 1918.

THERE has certainly been no lack of trouble on the part of the author to bring together all the possible data which could in any way help to throw light on the great problem of syphilis and the public health. This admirable volume appears at a moment when what we might call the "official" conscience has been awakened to the prevalence of syphilis, the large number of its innocent victims and the possibility of a national campaign against it. Colonel Vedder's own summing up of Chapter II contains the gist of the matter: "any sanitary measures taken for the prevention of syphilis which do not include some method for treating the problem of prostitution are doomed in advance to failure, since they will ignore the main source and root of the disease."

The book supplies such accurate and up-to-date knowledge on every possible relationship of syphilis to the individual and to the community both the military and the civilian, that it cannot fail to be a factor in creating a properly informed public opinion.

Already there is a campaign against the "quack".

The book closes with a valuable appendix on the technique

of the Wassermann test. The type, paper, and binding are excellent. There are no illustrations.

D. FRASER HARRIS, M.D.

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AIDS TO RATIONAL THERAPEUTICS, with U.S.A. Pharmacopœia Equivalents. By RALPH WINNINGTON LEFTWICH, M.D., C.M., M.R.C.S., late assistant physician to the East London Children's Hospital. 228 pages. Publishers: Baillière, Tindall & Cox, 8 Henrietta Street, Covent Garden, London, 1918.

THIS is an attempt to give the treatment of diseases brought together in what might be called natural groups. Thus we have such groups as the hæmorrhagic, which, of course, includes such conditions as hæmoptysis, hæmatemesis, dysentery, hæmophilia, purpura and epistaxis, in all of which bleeding is the common factor, although they are diseases of very different systems and organs. There is much to be said in favour of this "rational" classification; it presumes only such a knowledge of physiology as ought to be possessed by every student who reaches the study of therapeutics.

One result of this way of dealing with diseases is that it leaves a large number of heterogenous diseases as "ungrouped". These have nothing in common with each other, save the initial letter of their names, *e.g.*, we have cancer, carbuncle, conjunctivitis, and constipation all dealt with in one innominate group. But, after all, no real harm is done because any one in a hurry to turn up the treatment of a given disease would turn up the name of the disease in the index and not concern himself in the least with the disease dealt with just before or just after the one he was in search of.

There is an interesting personal note running throughout the book. The practical directions to physicians as to how they ought to comport themselves in the sick-room are excellent; they are the headings for a lecture in medical ethics. We do not see why the directions should have been limited to thirteen. The size of the book permits it to be carried in the pocket, a very important thing in a book dealing with treatment. It is possibly one of the few, very few, treatises on therapeutics where the author not only quotes a comic opera librettist but also makes jokes entirely "on his own".

D. FRASER HARRIS, M.D.

TRANSACTIONS OF THE AMERICAN UROLOGICAL ASSOCIATION. Sixteenth Annual Meeting at Chicago, April 2nd, 3rd, 4th, 1917. Vol. XI. Published by Richard Fotheringham O'Neil, and others. Printed for the Association at the Riverdale Press, Brookline, Mass., 1918.

THIS volume contains, amongst other papers, the following:—chronic prostatitis; treatment of carcinoma of genito-urinary tract with radium; the verumontanum; several on median bar obstruction; diverticulum of the bladder; new growths of testis; sources of pus in urine; and cystoscopy.

The illustrations are beyond criticism and are numerous. We do not like "chronic" cut down to "chr.", as there is no reason for haste.

It is surely unnecessary to allude to the middle lobe of the prostate as "Home's gland"? Only the initiated could tell what were "the glands of Albarran": this usage savours of affectation.

We think "Röntgenogram" an ugly synonym for skiagram or radiogram.

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### Books Received

THE following books have been received and the courtesy of the publishers in sending them is duly acknowledged. Reviews will be made from time to time of books selected from those which have been received.

A MANUAL OF OTOLGY. By GORHAM BACON, A.B., M.D., F.A.C.S., formerly professor of otology, College of Physicians and Surgeons, Columbia University, New York, assisted by TRUMAN LAURANCE SAUNDERS, A.B., M.D., assistant professor of laryngology and otology, College of Physicians and Surgeons, Columbia University. Seventh edition, revised and enlarged, with 204 illustrations. Publishers: Lea & Febiger, New York and Philadelphia, 1918.

THE STATICS OF THE FEMALE PELVIC VISCERA. Vol. 1, in which the evidence of pathology, phylogeny and ontogeny, and clinical investigation, etc., is surveyed. By R. H. PARAMORE, M.D., F.R.C.S. 369 pages, with 26 illustrations. Price, 18s. net. Publishers: H. K. Lewis & Co., 136 Gower Street, London, W.C., 1918.

**THE PROTEOMORPHIC THEORY AND THE NEW MEDICINE.** An Introduction to Proteal Therapy. By HENRY SMITH WILLIAMS, B.Sc., M.D., LL.D., member of the National Committee for Mental Hygiene. 304 pages. Publishers: The Goodhue Company, 104 East 40th Street, New York, 1918.

**EQUILIBRIUM AND VERTIGO.** By ISAAC H. JONES, M.A., M.D., laryngologist, Philadelphia General Hospital. With an analysis of pathologic cases by LEWIS FISHER, M.D., laryngologist and otologist, Mt. Sinai Hospital, Philadelphia. Adopted as standard for medical division, Signal Corps, Aviation Section, by Surgeon-General, and Chief Signal Officer, U.S. Army. 432 pages with 130 illustrations. Price, \$5.00. Publishers: J. B. Lippincott Company, Philadelphia, London, 201 Unity Building, Montreal, 1918.

**NAVAL HYGIENE.** By JAMES CHAMBERS PRYOR, A.M., M.D., medical inspector, U.S. Navy. 471 pages with 153 illustrations. Price, \$3.00 net. Publishers: P. Blakiston's Son & Co., 1012 Walnut Street, Philadelphia, 1918.

**THE ERRORS OF ACCOMMODATION AND REFRACTION OF THE EYES AND THEIR TREATMENT.—A HANDBOOK FOR STUDENTS.** By ERNEST CLARKE, M.D., F.R.C.S., ophthalmic surgeon to the King George Hospital, etc., Fourth edition, 231 pages. Price, 6s. net. Publishers; Baillière, Tindall & Cox, 8 Henrietta Street, Covent Garden, London, 1918.

**CLINICAL CASE TAKING.** An Introduction to Elementary Clinical Medicine. By ROBERT D. KEITH, M.A., M.D., formerly principal of the King Edward VII. Medical School, Singapore. 96 pages. Price, 3s. 6d. net. Publishers; H. K. Lewis & Co., 136 Gower Street, London, W.C.

**PRINCIPLES AND PRACTICE OF INFANT FEEDING.** By JULIUS H. HESS, M.D., professor and head of the department of pediatrics, University of Illinois College of Medicine, etc. 323 pages with illustrations. Price, \$2.00 net. Publishers: F. A. Davis Company, Philadelphia; English Depot, Stanley Phillips, London, 1918.



## Medical Societies

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### SEVENTH ANNUAL CONVENTION OF THE PUBLIC HEALTH SERVICES OF THE PROVINCE OF QUEBEC

A SUCCESSFUL meeting of this Association was held in Fraserville, on July 26th and 27th. The programme included many important questions which brought up interesting and at times lively discussions. A feature which attracted much attention was the antituberculosis travelling exhibit of the Provincial Board.

Among the important questions discussed were: the venereal disease problem, statistics, public health nurse, teaching of hygiene in all the schools of the province and their medical inspection.

The paper on venereal diseases was delivered by Dr. E. Pelletier, secretary-director of the Superior Board of Health of the province, and the discussion was made by Drs. P. C. Dagnault, Ed. Laberge, J. A. Hutchinson, Arthur Simard, E. M. A. Savard, and M. J. Simard.

A good paper on the vital statistics of the Province of Quebec was presented by Dr. W. Bonnier, the statistician of the Provincial Board. It was discussed by Dr. E. Gagnon, G. E. Marquis, chief statistician of the Provincial Government, M. J. Simard and Dr. E. Pelletier.

The activities of the Public Health Nurse were fully explained by Dr. J. A. Baudouin, and his paper was discussed by Dr. J. O. Leclerc, Nurse M. H. Doiron, Drs. Ed. Laberge, J. A. Jarry, C. R. Paquin, E. M. A. Savard, E. Pelletier, Arthur Simard and E. Gagnon.

Honourable Mr. C. F. Delage, Superintendent of the Department of Public Instruction of the Province, highly endorsed the necessity of the teaching of hygiene and the general medical inspection of all the schools of the province.

The following resolutions were carried by the Congress:—

1. That paratyphoid fever be added to the list of contagious diseases to be reported.
2. That the law be amended to the effect that the municipalities be obliged to pay the expenses incurred by sending the Health

Officer to attend the Annual Meeting of the Congress of the Public Health Services of the Province.

3. That the Minister of Militia be invited to have the returned soldiers examined as to the existence of venereal diseases in Europe, and not when they have come back to this side of the Atlantic.

4. That the Superior Board of Health take the proper steps to see that the soothing syrups be analyzed and labeled as poison.

The next Convention will be held in Hull.

The officers are as follows:—Dr. Ed. Laberge, Montreal, president; Dr. U. Archambault, Mayor of Hull, vice-president; Dr. H. Palardy, District Inspector for the district of Hull, general secretary; Dr. J. Isabelle, Medical Officer of Health of Hull, local secretary.

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#### THE NEW BRUNSWICK MEDICAL SOCIETY

THE New Brunswick Medical Society held its annual meeting in St. John, on July 16th and 17th.

A very fair representation of the profession of the province was present, together with Dr. Powell, Montreal, Dr. Miner, of Calais, Me., Dr. Gordon, Montreal, and Dr. Nicholls, of Halifax, N.S.

The president, Dr. F. H. Wetmore, of Hampton, N.B., occupied the chair. In his address, he called attention to the fact that this was the thirty-eighth annual meeting of the Society, and of the thirty-seven members present at the first meeting, only seven were now living. He also made special reference to the demise, during the past year, of Dr. T. D. Walker, in middle life, long a valued and enthusiastic member of the Society, and of Dr. Boyle Travers, in the plenitude of years and a member of the first medical council of the province.

He referred with pride to the large number of members who have gone "overseas" in the interests of Canada and the Empire. He noticed the advance that had been so lately made in the treatment of septic wounds, and dwelt with satisfaction upon the prospect of an improved public health administration for the province. In this connexion he especially looked and hoped for a better control of tuberculosis and venereal diseases.

It was ordered by the Society that the President's address be published.

The succeeding programme was a pretty full one, and included

papers on "Vital Statistics", by the Hon. Dr. W. F. Roberts; "Medical Camping Grounds of To-day," by Dr. D. R. Moore; "Advanced Tuberculosis," by Dr. H. A. Farris; "The More Common Causes of Retention and their Treatment," by Dr. R. E. Powell, of Montreal; "A Talk on Pus Pelvis in a series of Five Hundred Laparotomies," by Dr. Miner, of Calais, Me.; "A Basis for Symptoms," by Dr. Gordon, Montreal; "Medical Research and the Great War," by Prof. A. G. Nicholls, of Halifax; "Vaccination against Experimental Poliomyelitis," by Dr. Abraham; "Enlarged Prostate," by Dr. W. W. White; "Congenital Hip," by Dr. G. A. B. Addy; "Cystoscopy," by Dr. Macaulay; "Common Diseases of the Nose and Throat in Relation to General Medicine," by Dr. Chipman; An X-ray demonstration by Dr. Allingham; Case reports by Dr. L. G. Penault; and medical and surgical clinics by Drs. Rowley, Barry, Emery and Curren.

Some amendments relative to the procedure of the Society meetings, looking to greater efficiency and interest were proposed by a committee having the matter in hand, and were adopted by the Society.

The Society will meet next year in St. John, on the second Tuesday of July.

Dr. Bentley, Registrar of the Council of Physicians and Surgeons of New Brunswick, reported Dr. J. E. Hache, Dr. E. A. Arseman, Dr. F. J. Donnelly and Dr. F. W. Stevenson as having passed the Council's examination for registration in New Brunswick. He announced that the medical register for the province contained two hundred and nineteen names.

The officers of the Society for the year 1918-19 are: George G. Melvin, president, St. John; H. S. Bentley, first vice-president, St. John; Hon. W. F. Roberts, second vice-president, St. John; J. D. Lawson, treasurer, St. Stephen; C. J. Veniot, recording secretary, Bathurst; A. E. Macaulay, corresponding secretary, St. John; G. A. B. Addy, H. A. Farris and J. R. Nugent, trustees.

### Medical Societies

- CANADIAN MEDICAL ASSOCIATION:**—President—Dr. H. B. Small, Ottawa. President-elect—Dr. S. E. Grondin, Quebec. Acting Secretary-treasurer—Dr. J. W. Scane, 836 University Street, Montreal.
- ACADEMY OF MEDICINE, TORONTO:**—President—Dr. D. J. Gibb Wishart. Secretary—Dr. J. H. Elliot, 11 Spadina Road. Treasurer—Dr. J. H. McConnell.
- ALBERTA MEDICAL ASSOCIATION:**—President—Dr. D. G. Revell, University of Alberta, Edmonton South. Secretary-treasurer—Dr. T. H. Whitelaw, Medical Officer of Health, Edmonton.  
Annual Meeting, Edmonton, 1918.
- ASSOCIATION OF MEDICAL OFFICERS OF THE MILITIA:**—President—Lt.-Colonel A. T. Shillington, A.M.C., Ottawa. Secretary—Captain T. H. Leggett, A.M.C., Ottawa.
- ASSOCIATION OF MEDICAL OFFICERS OF NOVA SCOTIA:**—President—Dr. George E. DeWitt, Wolfville. Secretary—Dr. W. W. Hattie, Halifax.
- BRANT COUNTY MEDICAL SOCIETY:**—President—Dr. E. R. Secord, Brantford. Secretary—Dr. M. N. Faris.
- BRITISH COLUMBIA MEDICAL ASSOCIATION:**—President—Dr. J. Glen Campbell, Vancouver. Secretary—Dr. H. W. Riggs, Vancouver.
- CALGARY MEDICAL ASSOCIATION:**—President—Dr. H. A. Gibson. Secretary—Dr. J. W. Richardson. Treasurer—Dr. J. V. Follett.
- CANADIAN ASSOCIATION FOR THE PREVENTION OF TUBERCULOSIS:**—President—Dr. J. A. Machado, Ottawa. Secretary—Dr. George D. Porter, Ottawa.
- CANADIAN HOSPITAL ASSOCIATION:**—President—Dr. H. A. Boyce, Belleville. Secretary—Dr. J. M. E. Brown, Toronto.
- CANADIAN PUBLIC HEALTH ASSOCIATION:**—President—Dr. J. W. Hattie, Halifax, Nova Scotia. Secretary—Dr. J. G. Fitzgerald, University of Toronto.  
Annual Meeting, Hamilton, May, 1918.
- CENTRAL SOUTHERN ALBERTA MEDICAL SOCIETY:**—President—Dr. J. S. Murray, Okotoks. Secretary-treasurer—Dr. G. E. Learmonth, High River.
- COLCHESTER-HANTS MEDICAL SOCIETY:**—President—Dr. J. W. T. Patton, Truro. Secretary—Dr. H. V. Kent, Truro.
- DUFFERIN MEDICAL SOCIETY:**—President—Dr. Rooney, Orangeville. Secretary—Dr. Smith, Shelburne.
- EDMONTON ACADEMY OF MEDICINE:**—President—Dr. C. U. Holmes. Secretary-treasurer—Dr. E. L. Garner. Library, 12 Credit Foncier Building.
- ELGIN COUNTY MEDICAL ASSOCIATION:**—President—Dr. F. F. McEwen, Aylmer. Secretary-treasurer—Dr. W. F. Cornett, St. Thomas.
- FRASER VALLEY MEDICAL SOCIETY:**—President—Dr. DeWolfe Smith. Secretary—Dr. D. F. Carswell.
- GUELPH MEDICAL ASSOCIATION:**—President—A. T. Hobbs. Secretary—J. Lindsay.
- HALDIMAND COUNTY MEDICAL ASSOCIATION:**—President—Dr. Hopkins, Dunnville. Secretary—Dr. Courley, Cayuga, Ont.



**Medical Societies—Continued**

- HALIFAX MEDICAL SOCIETY:**—President—Dr. John Cameron. Secretary-treasurer—Dr. Hugh Schwartz.
- HAMILTON MEDICAL SOCIETY:**—President—Dr. R. Y. Parry. Corresponding Secretary—Dr. Fred Harper. Treasurer—Dr. T. W. Blanchard.
- HURON MEDICAL ASSOCIATION:**—President—Dr. Machell. Secretary—Dr. Hunter, Goderich, Ont.
- KINGSTON AND FRONTENAC MEDICAL SOCIETY:**—President—Dr. W. Gibson. Treasurer—Dr. H. E. Day, Secretary—Dr. W. T. Connell, Kingston.
- LAMBTON COUNTY MEDICAL ASSOCIATION:**—President—Dr. J. E. Kidd, Wyoming. Secretary-treasurer—Dr. A. R. McMillan, Sarnia.
- LEEDS AND GRENVILLE MEDICAL SOCIETY:**—President—Dr. J. C. Mitchell, Brockville. Secretary-treasurer—Dr. F. S. Vrooman, Brockville.
- LONDON MEDICAL ASSOCIATION:**—President—Dr. E. Spence. Secretary-treasurer—Dr. C. A. Harris.
- LUNENBURG-QUEEN'S MEDICAL SOCIETY:**—President—Dr. J. W. Smith, Liverpool. Secretary—Dr. L. T. W. Penney, Lunenburg.
- MANITOBA MEDICAL ASSOCIATION:**—President—Dr. Daniel G. Ross, Selkirk. Secretary—Dr. A. T. Mathers, 803 Boyd Bldg., Winnipeg. Treasurer—T. Glen Hamilton, Winnipeg.
- MEDICAL OFFICERS OF HEALTH FOR COUNTIES OF LINCOLN AND WELLAND:**—President—Dr. King, St. Catharines. Secretary-treasurer—Dr. Howell, Welland.
- MEDICAL SOCIETY OF NOVA SCOTIA:**—President—S. H. Murphy, Halifax. Secretary-treasurer—Dr. J. R. Corston, Halifax. Annual Meeting, Antigonish, 1919.
- MEDICINE HAT MEDICAL SOCIETY:**—President—Dr. W. H. Macdonald. Vice-President—Dr. C. E. Smyth. Secretary-treasurer—Dr. J. S. Macleod.
- MIDDLESEX COUNTY MEDICAL ASSOCIATION:**—President—Dr. A. S. Thompson, Strathroy, Ontario. Secretary-Treasurer—Dr. W. H. Woods, Mount Bridges, Ontario.
- MONTREAL MEDICO-CHIRURGICAL SOCIETY:**—President—Dr. A. E. Garrow. Acting Secretary and Treasurer—Dr. D. Grant Campbell.
- MOOSE JAW MEDICAL SOCIETY:**—President—Dr. J. M. Hourigan. Secretary-treasurer—Dr. J. Bloomer.
- NEW BRUNSWICK MEDICAL SOCIETY:**—President—Dr. G. G. Melvin, St. John. Corresponding Secretary—Dr. A. E. Macaulay, St. John. Treasurer—Dr. J. D. Lawson, St. Stephen.
- NORTH-WESTERN MANITOBA MEDICAL ASSOCIATION:**—President, Dr. F. A. Smith, Birtle. Secretary-treasurer—Dr. Tisdale, Kenton.
- NORTH WATERLOO MEDICAL ASSOCIATION:**—President—Dr. F. H. Kalbfleisch. Secretary—Dr. J. E. Hett, Kitchener. Treasurer—Dr. T. H. Callahan.
- NIAGARA DISTRICT MEDICAL ASSOCIATION:**—President—Dr. E. T. Kellam, Niagara Falls. Secretary—Dr. G. M. Davis, Welland.
- NORTHUMBERLAND COUNTY MEDICAL SOCIETY:**—President—Dr. McKenzie, Loggieville, N.S. Secretary-treasurer—Dr. Hayes, Nelson, N.S.
- ONTARIO HEALTH OFFICERS' ASSOCIATION:**—President—Dr. H. W. Hill, London, Ontario. Secretary—Dr. J. W. S. McCullough, Toronto.
- ONTARIO MEDICAL ASSOCIATION:**—President—Dr. John P. Morton, Hamilton, Treasurer—Dr. J. H. Elliott, Toronto. General Secretary—Dr. F. Arnold Clarkson. Assistant Secretary—Dr. F. C. Harrison.
- OTTAWA MEDICAL SOCIETY:**—President—Dr. A. T. Shillington. Secretary—Dr. J. A. Dobie. Treasurer—Dr. R. E. Valin.

*Medical Societies—Continued*

- OTTAWA MEDICO-CHIRURGICAL SOCIETY:—President—Dr. A. T. Shillington, Secretary—Dr. J. A. Dobbie Treasurer—Dr. R. E. Valin.
- OXFORD COUNTY MEDICAL ASSOCIATION:—President—Dr. J. M. Stevens, Woodstock. Secretary-Treasurer—Dr. G. M. Brodie, Woodstock, Ontario.
- PERTH COUNTY MEDICAL ASSOCIATION:—President—Dr. A. D. Smith, Mitchell. Secretary-treasurer—Dr. F. J. R. Forster, Stratford, Ontario.
- PETERBOROUGH MEDICAL SOCIETY:—President—Dr. N. D. Buchanan, Secretary—Dr. G. Stewart Cameron. Treasurer—Dr. J. Malcolm McCulloch.
- PICTOU COUNTY MEDICAL ASSOCIATION:—President—Dr. C. S. Elliott, Stellarton. Secretary—Dr. John Bell, New Glasgow.
- PRINCE EDWARD ISLAND MEDICAL SOCIETY:—President—Dr. G. F. Dewar, Charlottetown. Secretary—Dr. Yeo, Charlottetown. Treasurer—Dr. W. J. MacMillan, Charlottetown.
- REGINA MEDICAL SOCIETY:—President—Dr. Gorrell. Secretary—Dr. Dakin.
- ST. JOHN MEDICAL SOCIETY:—President—Dr. D. Malcolm. Secretary—Dr. F. P. Dunlop.
- ST. THOMAS MEDICAL ASSOCIATION:—President—Dr. Alexander Turner. Secretary-treasurer—Dr. James A. Campbell.
- SANITARY SERVICES OF THE PROVINCE OF QUEBEC:—President—Dr. A. Simard, Quebec. Secretary—Dr. J. A. Beaudouin, Lachine.
- SASKATCHEWAN MEDICAL ASSOCIATION:—President—Dr. J. V. Cornell, Secretary—Dr. J. W. Turnbull, Regina.
- SASKATCHEWAN ANTI-TUBERCULOSIS LEAGUE—President—Mr. A. B. Cook. Hon.-Secretary—Dr. M. M. Seymour, Commissioner of Health, Regina.
- SASKATOON MEDICAL ASSOCIATION:—President—Dr. W. A. Cluff. Secretary—Dr. A. F. Malloy.
- SIMCOE COUNTY MEDICAL ASSOCIATION:—President—Dr. T. J. Johnston, Midland. Secretary-treasurer—Dr. H. T. Arnall, Barrie.
- SOCIÉTÉ MÉDICALE DE MONTRÉAL:—President—M. B. G. Bourgeois, Secretary—H. M. Aubry, 323 Sherbrooke Street East, Montreal.
- SOCIÉTÉ MÉDICALE DU DISTRICT D'OTTAWA:—President—Dr. M. Aubry. Secretary—Dr. M. J. E. D'Amour, Papineauville.
- SOCIÉTÉ MÉDICALE DE QUÉBEC:—President—Dr. M. Savard. Secretary—Dr. M. Couillard, Quebec.
- SOCIÉTÉ MÉDICALE DE TROIS-RIVIÈRES:—President—Dr. M. Deblois. Secretary—Dr. O. Darche.
- SWIFT CURRENT DISTRICT MEDICAL ASSOCIATION:—President—Dr. Graham. Secretary-treasurer—Dr. Hughes.
- THUNDER BAY MEDICAL SOCIETY:—President—Dr. E. B. Oliver, Fort William. Secretary-treasurer—Dr. J. G. Hunt, Port Arthur.
- TWIN CITY MEDICAL ASSOCIATION:—President—Dr. W. L. Hilliard. Secretary—Dr. J. E. Hett, Berlin, Ont. Assistant Secretary—Dr. G. E. Chapman.
- VALLEY MEDICAL SOCIETY:—President—Dr. M. E. Armstrong, Bridgetown. Secretary—Dr. T. M. MacKinnon, Berwick, N.S.
- VANCOUVER MEDICAL ASSOCIATION:—President—Dr. J. W. Ford. Vice-President—Dr. G. B. Murphy. Secretary—Dr. A. V. Webster.
- WEST ELGIN MEDICAL SOCIETY:—President—Dr. D. A. Cameron, Dutton. Secretary-treasurer—Dr. D. J. Galbraith, Dutton.
- WINNIPEG MEDICAL SOCIETY:—President—Dr. J. E. Lehmann. Treasurer—Dr. A. W. Allum. Secretary—Dr. G. S. Fahani, 507 Boyd Bldg.